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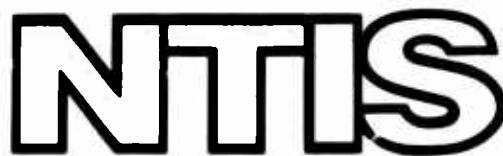
EFFECT OF INSTRUCTOR UNIFORM (ARMY,  
NAVY, AIR FORCE, CIVILIAN) ON LEARNING  
AND PERCEPTION OF BASIC AIRMEN TAUGHT  
THROUGH THE MEDIUM OF TELEVISION

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EFFECT OF INSTRUCTOR UNIFORM (ARMY, NAVY, AIR FORCE,  
CIVILIAN) ON LEARNING AND PERCEPTION OF BASIC  
AIRMEN TAUGHT THROUGH THE MEDIUM OF TELEVISION

Ronald R. Calkins, Lieutenant Colonel, USAF

The objective was to determine (for neutral topic material) whether learning and attitude of basic airmen would be effected by using instructors from different branches of Department of Defense Services teaching through the medium of television.

Four twenty minute television lessons were produced on the topic "How To Study." The only controlled differences were the treatment variables; i.e., uniform of the instructor, Air Force, Navy and Army E-5 and a business suit for a Civilian Service Employee.

A test measured learning and attitude. Differences between groups in attitude would indicate whether identification with the Air Force uniform was a relevant dissonance arousing agent. If there were differences in attitude, then differences were expected in learning.

A matched stratified random sample of 360 subjects was selected from a population at Lowry AFB, Colorado. Each treatment group consisted of 90 subjects matched for age, sex, education achievement and length of service. Each treatment group was stratified into three ability levels on five standardized intelligence and aptitude scores.

One way analysis of variance indicated no statistical differences in learning between treatment groups by stratum and combined strata. Chi Square tables indicated no significant differences in attitude within treatment groups by stratum.

Instructor uniform created no differences in learning or attitude when students were taught a neutral subject through the medium of television. The model may be useful for attempting to discover dissonant producing situations that effect attitude and cognitive learning.

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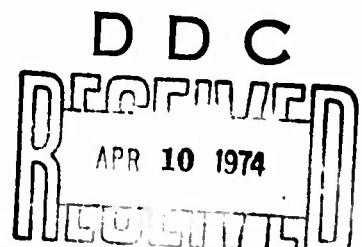
By

Ronald R. Calkins  
Lieutenant Colonel, USAF

March 1974

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## Chapter 1

### BACKGROUND AND JUSTIFICATION FOR THE STUDY

#### Statement of the Problem

The purpose of this study was to determine whether cognitive learning scores and affective responses (hereafter referred to as "perceptual distortion indicates") of United States Air Force basic airmen would be affected by utilizing educational television instructors from different branches of Department of Defense services.

#### Justification for the Study

Justification for this study was based on three considerations. The first consideration is offered in terms of practical results. The second consideration is presented in terms of the kinds of research needed within the medium of instructional television. The third consideration is offered as one of many possible approaches in support of needed research in learning theory.

Practical considerations. Continual training is characteristic of military life. In addition to regular weekly periods of training, the average career military person attends a technical or professional school approximately once every three years. The scope of military involvement in education and training is apparent when one considers that there are more than 2.5 million people in the uniformed military services. And the proportion of this military training conducted

through the medium of television is significant and ever increasing (Lowry Technical Training Center, 1969).

Each military service supports an autonomous audio-visual organization designed to produce programs for a single military service need. The producing service is identifiable in the introduction and conclusion of the program as well as through the visual context and language inherent in the script. Except for a few programs which utilize civilian instructors, the majority of programs are produced in relation to a single service need in which the instructor wears the uniform of that service and teaches a subject peculiar to and readily identifiable with his branch of service.

In 1967 a Department of Defense joint military services panel was established to determine the feasibility of consolidating some of the overlapping audio-visual functions of the separate services. One proposal was to coordinate the production and dissemination of common interest taped instructional television programs to all branches of the military service, regardless of the originating organization (Departments of The Army, The Navy, and The Air Force, 1967). Considerable economy may result if the use of such programs would not be related significantly to lower learning rates.

An obvious question inherent in joint military services use of common interest television is the strength of identification possibly associated with the uniform of the instructor. Whether this in turn would affect learning is a matter of practical concern.

In keeping with these practical considerations, support for this study was provided by two sources. Television production facilities,

the loan of two inch video tapes, test forms and the use of an optical scanner and computer services were provided by the Air Force Academy.

In March, 1970 the Human Resources Laboratory secured authority from Headquarters, Air Training Command to conduct the experiments and provide access to the personnel records at Lowry Air Force Base. The Human Resources Laboratory, located at Lowry Air Force Base, sponsored the project and provided liaison services between the author and the various support agencies.

Instructional television. Most of the research in instructional television consists of comparative studies. For example, the studies compare an instructional situation in the television medium of communication with an instructional situation in the live medium of communication to determine which medium is the most efficient in terms of learning. The literature about educational television suggests the need for non-comparative studies within the medium of television itself. The results of a recently completed study at Lowry Technical Training Center (1968) indicate that educational television research has been centered almost exclusively on comparing television with other media of instruction. Research reveals that educational television is neither the panacea for all educational problems nor the doom of the human and personal element in the profession of education. There appears to be little need or justification for additional studies which compare conventional versus educational television methods of instruction. However, educational television as a medium of instruction is almost totally dependent, at this time, upon intuitive trial-and-error experimentation without analytical controls; it lacks a

firm empirical basis. Therefore, the most promising path is not more redundant studies, but research focused toward improving the educational efficiency of the television medium itself without reference to other media of instruction.

Chu and Schramm (1967) arrived at a similar conclusion:

For one thing, it has become clear that there is no longer any reason to raise the question whether instructional television can serve as an efficient tool of learning . . . The questions worth asking are no longer whether students learn from it, but rather, (1) does the situation call for it, and (?) how, in a given situation, can it be used effectively [98]?

A review of instructional television literature testified that this study was almost unique as non-comparative research wholly within the medium of television and directed toward the efficient use of television in a given situation.

An approach to learning theory. As Gage (1966) believed there had been little research on cognitive achievement compared to research in the affective areas of learning, he also suggested that most research on teaching behavior and student achievement was descriptive in nature. Descriptive studies limit research to the best available rather than discovering the best possible. This is because many descriptive studies attempt to model or copy a master teacher. Stolurow (1965) believed this approach was ineffective because:

The most significant conclusion that can be drawn from efforts to use teachers as a basis for information about teaching is that effective instruction can be produced by a variety of combinations of characteristics and conditions rather than by one unique combination. If this were not the case, efforts to enumerate the characteristics of good teachers would have resulted in the identification of at least one or two critical characteristics. However, neither the observation of master teachers nor that of a

large number of effective teachers . . . has led to findings that are either substantial or sufficient for the understanding of teaching as a process. Thus, an alternative approach is needed [225-226].

The alternative approach that Stulurow (1965) suggested was called, "mastering the model teacher." Stulurow believed it possible to do a better job of teaching than that which had been observed in the master teachers because master teachers may also possess inadequacies. All too often research is limited to what teachers are doing now. Models should be developed to predict learning outcomes. These models would master the model teacher rather than copy a master teacher. They would force the investigator to enumerate and control for the variables responsible for the prediction. Stulurow contends that if the models were designed properly, they could be tested and corrected.

The conceptual model for this study was designed to test some aspects of learning theory. It was designed around Festinger's (1957) theory of cognitive dissonance to experimentally predict and test for the interaction of cognitive learning achievement and perceptual distortion. If successful, the model could be applied to a variety of contemporary issues that involve race and the underprivileged classes of society regarding their group norms and resultant expectations toward the teacher and the learning environment.

Research in the affective areas of learning indicates that group norms affect student perception (Berlson and Steiner, 1964; Wiman and Meierhenry, 1969; McDavid and Harari, 1968). But perception was also of interest to researchers on the cognitive side of learning. In his book Theories of Learning, Hilgard (1956) identified special areas in

which research was needed to either prove or repudiate all major learning theories:

The problem of perceptual discrimination is a central one for learning theory. There is some uncertainty as to the manner in which perception is natively organized . . . The perception of objects suffices to show that there is at least some learning [reflected] in perception. A cake of ice looks cold; the red tip of a poker looks hot. The properties of cold and hot, not present to the senses [heat sensors] are present in [visual] perception as a result of prior experiences. They are not judgments or deliberate inferences from perceptual data, but are given as immediately as any of the properties of perceived objects [465-466].

In his book, A Theory of Cognitive Dissonance, Festinger (1957) provided a theory that possibly could be adapted to experimentally predict and test for the interaction of cognitive achievement and perceptual distortion. The theory perhaps would help to bridge the gap between the relationships of some affective and cognitive elements of learning.

According to Festinger's theory, every individual has non-specific activating properties which the author will refer to as psychic energy. People use psychic energy to drive or continually strive for an orderly and meaningful understanding of reality. Through experience they learn to expect reality to be in consonance. This means to be in balance or internally consistent. When there is dissonance, psychic energy is directed toward the restoration of cognitive balance. The cognitive experiences are interrelated in such a manner as to be consistent or balanced with the totality of experience. Thus, for example, perception, attitude, and learning are not unrelated but are part of an overall personality organization.

Dissonance reduction may be accomplished by either physically or psychically avoiding situations in which dissonant stimuli occur. Psychic avoidance may be accomplished by resorting to perceptual distortion.

### Overview

The overview is intended to serve three purposes. First, the "conceptual model" is discussed in terms of a logical approach called the process of inquiry. Secondly, the statistical design and procedures employed in the study are discussed in terms of the "experimental model." These references to the "conceptual model" and the "experimental model" serve to introduce and explain many of the terms used in the remainder of the study. The conceptual model and the experimental model form the background necessary to serve the third purpose of the overview. That purpose is to introduce the "proposition."

In this manner the "proposition" can be logically introduced as a substitute for a traditional hypothesis. The reader should make a distinction between the terms "conceptual model" and "experimental model." The reader may then visualize how the conceptual and experimental models are applied as they are brought together in the proposition and discussed in the explanation that follows the statement of the proposition.

The satisfaction of these three purposes in turn establishes some basis in logic for the remainder of the study. For example, Chapter 2 is a critical review of dissonance theory. This overview should provide a minimal background so that in Chapter 2 dissonance theory may be discussed in terms of both the critical issues of the conceptual and experimental model. Then in Chapter 3, the experimental

model and procedures are introduced with some confidence that the reader will be able to judge the design of the experimental model in terms of whether it is capable of capturing and applying the theoretical elements of the conceptual model that were presented in Chapter 2.

Conceptual model. The study began with an abstract concept. The concept was applied through a process of inquiry that led logically to experimental design that permitted testing the null hypotheses. This process of inquiry followed the elements of scientific inquiry developed in Social Research: Strategy and Tactics by Phillips (1969). The process of inquiry involved in descending levels of abstraction concept, theory, proposition, and experimental hypotheses.

Concepts were interpreted as ways of perceiving phenomena at high levels of abstraction. Underlying this study was the concept that there may be an interaction between the affective and cognitive elements of learning. A student expectation assumed by the author to be commonly held and therefore to act as a group norm is that as airmen wear the Air Force uniform they expect to be taught by military personnel wearing the same uniform. This affective element may be strong enough to affect adversely cognitive learning when airmen are taught by non-Air Force instructors.

At the next lower level of abstraction, "theory" is interpreted as being a system of related propositions. In the social sciences theory merely specifies to a degree relations among propositions. In this manner due recognition may be given to many formulations within social science which are not highly systematic but nevertheless represent important contributions. To address the conceptual question,

Chapter 2 is devoted to a critical review of the theory of cognitive dissonance. Cognitive dissonance formed the theoretical basis to develop a "proposition" to predict and test for results in terms of an experimental model.

The term "proposition" is at the next lower level of abstraction. The term proposition in this sense is a statement or prediction about the affect of phenomena being investigated. Although the proposition should be considered a substitute for and similar to a traditional hypothesis it is different in that the proposition should not be thought of as separate from the explanation that interprets the prediction in terms of the experimental and conceptual models. The proposition and explanation is an attempt to apply the theory underlying the conceptual model to the design of the experimental model.

The "experimental hypothesis" is at the lowest level of abstraction. An experimental hypothesis is defined as a very specific statement or prediction about elements within the proposition being tested. As such the experimental hypothesis is expressed in the null form appropriate to statistical treatment. The experimental hypotheses are stated in Chapter 4.

Experimental model. The design of the experimental model called for the television medium as a means of control, a closely matched population, and an instrument yielding results which could be used to test for differences in both the cognitive and affective elements mentioned in the conceptual model discussed above. The design of the experimental model and procedures are in Chapter 3. Only the main elements of the procedure and terminology follow.

A population study undertaken prior to the beginning of the experiment indicated the parameters of a subject population that could be expected for the experiments that were to follow. The population study also suggested a means for matching and stratifying subjects that would be appropriate to the proposition and experimental model.

Next, a television lesson script was completed on the topic, "How To Study," (Appendix A). Four twenty-minute television programs were recorded on video tape. The only differences in the taped television programs were called uniform or "treatment variables." The treatment variables were Air Force Technical Sergeant uniform, Navy Petty Officer First Class uniform, Army Staff Sergeant uniform and a business suit typical of a United States Civil Service employee. Except in the case of the civilian the uniforms represented equivalent military rank.

The subject population consisted of basic airmen at Lowry Air Force Base. The term, "subject" refers only to a person who met certain criteria and was used as a subject in an experiment. Qualification as a subject involved a two step process. Potential subjects were required to meet both matching and stratification criteria. The matching criteria consisted of general population parameters in terms of age, sex, educational achievement level and length of time served in the United States Air Force. The stratifying criteria consisted of certain ranges of achievement scores in an intelligence test and four aptitude tests. These test scores were used to place subjects into high, medium and low ability groups. These three ability levels were referred to as "strata."

A test instrument was devised so that the group results of the test could be analyzed for differences in the cognitive and affective elements mentioned under the conceptual model above. For example, group scores of a forty-two item test (Appendix C) over the "How To Study" television lesson were used as the "criterion variable" of the cognitive element. The "criterion variable" was used to suggest if there were differences in cognitive learning within groups corresponding to the treatment variables consisting of different instructor uniforms. The term "within" refers to a horizontal analysis across treatment variables to ascertain if there were any differences in learning and perception associated with the uniform of the television instructor (treatment variable).

Opinion questions were devised as a test of the affective element of the concept (Appendix B). The answers to these three questions were referred to as "perceptual distortion indicates." The perceptual distortion indicates (inserted at the beginning of the forty-two item cognitive test) were merely the results of three opinion questions based on a five point Likert type scale. Each question was designed to suggest student perception from a very positive to a very negative reaction. The reaction was an indication of perception. These opinion questions were designed so that the answers would indicate differences in "perception" of (1) television as a medium of instruction, (2) the instructor as a teacher, and (3) the subject material of the televised lesson. The answers to these questions in terms of treatment group results would indicate whether perceptual distortion had occurred. This purpose provided the basis for employing the term "perceptual distortion indicates."

Group results of the perceptual distortion indicate scores were used as "analytical variables" for the affective element of the conceptual model. These "analytical variables" or perceptual distortion indicate group scores served a threefold purpose. First, the group scores suggested whether cognitive dissonance was present relative to a particular treatment variable. Second, differences within the treatment group scores suggested if the assumed group norm was correct. And third, if the assumed group norm appeared to be different from what was expected, an analysis of the perceptual distortion indicate group scores would suggest where the group norm was centered in terms of identification with a particular treatment variable of instructor dress.

The experimental hypotheses in Chapter 4 can be tested for statistical significance. They are very specific predictions about the elements of the proposition that will be discussed later. Along with the statistical treatment, the experimental hypotheses were designed to analyze differences in both learning and perception within treatment variables by ability stratum. It was predicted that inspection of the statistical results of the experimental hypotheses would reveal that (in reference to groups of subjects who viewed the Air Force Technical Sergeant instructor) groups of subjects viewing the incongruent instructors should score significantly different in terms of both the cognitive and affective (criterion variables and analytical variables) elements of the concept. Groups of subjects having statistically significant lower cognitive element scores would have statistically significant more unfavorable affective element scores. A representation of the design of the experimental model is presented in Tables 1 and 2 in Chapter 3.

Proposition. The proposition is introduced at this point as a substitute for the traditional statement of the hypothesis and to bring the conceptual and experimental models into focus. The proposition is restated near the beginning of Chapters 3 and 4 for the convenience of the reader.

The statement of the proposition is: Subjects viewing the Air Force Technical Sergeant instructor would learn more than their counterparts who viewed incongruent instructors not wearing the Air Force uniform. Further, subjects viewing the Air Force Technical Sergeant instructor would more favorably rate the perceptual distortion indicates than their counterparts who viewed incongruent instructors not wearing the Air Force uniform.

The explanation of the proposition in relation to the theoretical basis of the conceptual model and the design of the experimental model is: Learning would be measured by the criterion variable or group scores of the test on "How To Study." Perceptual distortion would be measured by the analytical variables or group scores on the opinion questions. Conceptually, the cognitive element was represented by the criterion variable while the affective element was represented by the analytical variables. The group norm (identification with the Air Force uniform) would be both relevant and strong enough to create cognitive dissonance when subjects were forced into a situation where they viewed an instructor who was cognitively inconsistent with their expectations. Since subjects couldn't avoid the physical situation, congruence would be attained by perceptual distortion. Some of the psychic energy would be directed toward attaining cognitive balance rather than learning. This

energy drain would be reflected in more unfavorable perceptual distortion indicates referred to as analytical variables. Other factors being equal, there would be a relationship by inspection between the perceptual distortion indicates and decreased learning in that the same subject cells would be significantly different in terms of analytical variables and the criterion variable. Differences in perceptual distortion would indicate whether dissonance was experienced by subjects within treatment variables. An assumed group norm was necessary for prediction purposes. However, differences in analytical variables within treatment variables would suggest whether there were differences in identification associated with a particular uniform and the assumed group norm could be altered accordingly.

## Chapter 2

### REVIEW OF THE LITERATURE

#### Introduction

Cognitive dissonance theory, as postulated by Leon Festinger in 1957 and as further developed and refined by a number of social psychologists provides a unique paradigm from which to both predict and interpret behavior in interpersonal situations. The theory is particularly valuable when it is able to predict and explain behavior which is not amenable to interpretation by more conventional psychological theories such as when a person perceives an event but literally does not believe it (Brehm and Cohen, 1962). The review of literature is placed within the context of this dissonance theory.

Cognitive dissonance is a psychological tension having motivational characteristics. The theory deals with the conditions which arouse dissonance in an individual and the ways in which dissonance can be reduced. Cognitions, or cognitive elements, are items of information or ideas which one has about himself or his environment. The relationship between any two cognitions is consonant if one implies or supports the other in some manner. A dissonant relationship exists between two cognitions when the person possesses one which follows from the counterpart of the other he possesses. Thus, if A implies B, then holding cognition A and the opposite of cognition B is dissonant. When the individual holds cognitions at any given time, among which there are one

or more dissonant relationships, he will experience the motivational tension of dissonance. Those cognitions which are neither consonant nor dissonant are said to be irrelevant (Brehm and Cohen, 1962). For example, the cognition that it is raining is irrelevant to the cognition that you are eating; unless you are eating outdoors.

#### Evolution of Homeostatic Concepts

Theories on dissonance, self-consistency and balance are similar and were classified by Monaghan (1970) as homeostatic concepts:

If one were to attempt a historical review of the balance theories, it would be exceedingly difficult to know just where to begin or point to the origin of the concept. Perhaps one could argue that this notion has origin as long ago as Aristotle's concept of the Golden Mean, and that this concept should be considered the fountainhead of present day theory [1-2].

Lecky was probably one of the first psychologists to attempt an investigation and explanation of a broad concept of self-consistency. Lecky's (1951) principle of self-consistency was the result of some original experiments and a reinterpretation of a wide range of research and the literature of psychology at the time.

Lecky (1951) began working on the concept around 1922. He published little and continued crystallizing the principle until his death in 1941. Former students gathered his lectures, notes and manuscripts to be edited into a book which first appeared in 1945. Lecky was influenced by personal contact with Adler and the Gestalt concept that the essential nature of a complex organism is in its dynamic pattern of organization. The principle of self-consistency is perhaps best associated with material originally generated by Lewin, Adler, Tolman and Gestalt psychology.

From this platform Lecky (1951) launched into a pragmatic approach to psychological literature. He inferred the principle from a wealth of theories and experiments. Eventually he was able to reinterpret many of the theories and much of the research to agree with the principle of self-consistency. To Lecky, the concept of a unified personality emerged as a logical necessity. It was the only generalization capable of organizing and harmonizing the data in full perspective.

Lecky (1951) postulated that all behavior represents the operation of a universal dynamic principle defined as the striving for unity or self-consistency. The organization of values, feelings, ideas and attitudes which evolved from the organism meeting its environment must be kept internally consistent. The nucleus of this organization is the individual's feelings about himself or self-image. Thus the meaning of an experience received through the sense organs is purely subjective. From sensory perception the individual learns to predict what is reality. He gains confidence if the predictions are good. He loses confidence if the predictions are wrong. The interpretation of experience begins at birth or perhaps earlier.

The criterion for whether an idea has been accepted completely is the behavior of the person, for once an idea has been assimilated it must be maintained by the person unless displaced by a reorganization of ideas. Ambivalent behavior in all areas indicates an unstable nucleus lacking in self-consistency in which contradictory ideas or interpretations compete for acceptance. When an idea or cognition is finally accepted and the other rejected, ambivalence disappears as internal consistency is achieved (Lecky, 1951).

The organization of ideas is unstable and inconstant since it is continually modified by new experience. This results in a chronic process of assimilation and reorganization governed by the universal principle, the striving for self-consistency. This unique organization of ideas is the only one the individual has; therefore he must strive to maintain it. While outside forces may attempt to change the person, only the individual can reorganize his experience into an integrated whole (Lecky, 1951).

This concept of self-consistency is related closely to the more modern theories of Heider (1946), Osgood and Tannenbaum (1955), Festinger (1957), Sherif (1965) and Rokeach (1969) in that inconsistent ideas or cognitions would only effect behavior to a significant degree when the self-image was involved. Deep ego-involvement in a dissonant situation would create disorganization and a restructuring of values before consistency could again be attained. Assimilation of ideas at the peripheral levels of ego-involvement would not necessarily create behavioral manifestations.

In this study it was necessary to determine whether identification with the Air Force is an ego-involved element sufficient to create dissonance when non-Air Force instructors are utilized for teaching basic airmen. The analytical variables referred to as perceptual distortion indicates were designed to suggest the presence of dissonance if differences were found within the treatment or uniform variables. For subject cells where dissonance was present, the learning rate was predicted to be lower.

Apparently Lecky (1951) held that dissonance could be temporary. He viewed organizational processes as dynamic, constantly changing and being modified with the maturation of an individual. Personality was a unified scheme of experience, an organization of values consistent with one another. Interpreting this in the light of subsequent literature by Sherif (1965) and Rokeach (1969), it has become apparent that most ideas do not require a reorganization of the value structure. However, attitudes are occasionally modified and opinions are replaced constantly.

Lecky (1951) viewed resistance and assimilation as natural processes that were neither positive nor negative. Lecky (1951) believed that the individual learns that he must face inconsistencies in order to develop and progress:

. . . the organism cannot continue to develop, or succeed in maintaining its unity, except by repeatedly facing new conflicts and risking the security it wishes to attain. Learning is not mechanical but adventurous. If a certain type of situation has been assimilated, its presence tends to support the attitude of confidence, but if it has not been assimilated the normal attitude is threatened, and the process of assimilation itself brings about a temporary disturbance. Thus the problem . . . is that of maintaining and strengthening the normal attitude by gradually assimilating the situations which formerly had a disturbing effect [147].

Thus Lecky did not view man as reacting only to self-consistency. Rather, he saw man as reactive in a general sense and according to his own terms.

Most of the earlier homeostatic theories were concerned with attitude change. Zajonc (1960) and Monaghan (1970) credit Heider (1946) as providing impetus for the current interest in balance theory. Heider (1946) treated and derived certain hypotheses which were published in a journal article. Heider postulated:

Attitudes toward persons and causal unit formation influence each other. An attitude toward an event can alter the attitude toward the person who caused the event, and if the attitudes towards a person and an event are similar, the event is easily ascribed to the person. A balanced configuration exists if the attitude toward the causal units are similar [107].

His basic question was whether cognitive structures interact with attitudes. Apparently, Heider used the principle of self-consistency to postulate the balance/imbalance propositions to predict that imbalance would create a tendency to restructure in order to attain a balanced condition.

In subsequent experiments the hypotheses produced generally valid predictions under controlled experiments (Jordan, 1963). Perhaps more than anything else Heider's proposition provided a model whereby researchers could predict forces and means toward actions from simple cognitive configurations suitable for controlled experimental conditions. Heider (1946) believed that the hypotheses indicated theoretically that much behavior and perception is at least co-determined by simple cognitive configurations. Heider found a predictive handle for Lecky's concept that was expanded upon by other researchers. Zajonc (1960) cited Cartwright and Harary (1956), Newcomb (1953), Kelman and Hovland (1953) as others who used Heider's ideas as the basis for experiments and propositions to predict behavior on the basis of homeostatic concepts.

Both Monaghan (1960) and Zajonc (1960) credited Osgood and Tannenbaum with the next significant contribution to homeostatic theory. The authors developed their work on attitude scales (called the semantic differential) with the principle of self-consistency to formulate some propositions to predict and measure both the direction and magnitude of attitude change under experimental conditions.

Osgood and Tannenbaum (1955) identified three variables in communication: (1) attitude toward source, (2) attitude toward concept evaluated by the source, (3) nature of the evaluative assertion relating source and concept in the message. Attitude was believed to be a projection of evaluative nature.

Osgood and Tannenbaum's (1955) basic principle of congruity stated that ". . . changes in evaluation are always in the direction of increased congruity with the existing frame of reference [43]." The issue of congruity arises whenever a message is received which relates two or more objects of judgment via an assertion. Without the assertion it is possible to have incompatible attitudes toward diverse cognitions without any felt incongruity or pressure toward attitude change. For example, people may keep logically incompatible attitudes toward objects in their culture without stress as long as the incompatibles are not associated. Hence the concept of equality and racial prejudice are attitudinally compatible as long as a message doesn't associate or assert the incompatibility.

Unlike Heider, these authors examined the magnitude of attitude including the possibility of no attitude at all. This gave credence to Lecky's (1951) arguments concerning degrees of ego-involvement necessary for the arousal of dissonance. Osgood and Tannenbaum (1955) used the principle of self-consistency and the semantic differential to measure direction and magnitude of change toward balance with three variables in experimental conditions. After experimentation, the predictions were corrected for incredulity. A correction table was devised to consider the incredulity associated with highly credible sources asserting very

incredible statements. Once the correction factor was applied, the basic prediction of direction proved statistically significant in controlled conditions. The magnitude of attitude change was generally supported in that a trend was established. Zajonc (1969) listed other studies by Moore (1921) and Sherif (1935), which tended to confirm the postulates of Osgood and Tannenbaum.

The study by Osgood and Tannenbaum is related to this investigation. Identification with the Air Force uniform would render the Air Force Technical Sergeant a credible source. The uniform of the other instructor variables would render these sources of communication as being not credible.

#### Dissonance Avoidance

Monaghan (1970) believed that all homeostatic concepts have two underlying assumptions. These concepts assume that imbalance creates tension because man imposes meaning on environment consistent with his experiences. Any inconsistency creates tension because man's concept of the world and his ability to affect it becomes imbalanced. The second assumption is that man seeks to reduce or avoid tension by actively seeking the most balanced condition.

Festinger's (1957) assessment was similar. He identified two hypotheses of dissonance theory:

1. The existence of dissonance, being psychologically uncomfortable, will motivate the person to try to reduce the dissonance and achieve consonance.
2. When dissonance is present, in addition to trying to reduce it, the person will actively avoid situations and information which would likely increase the dissonance [3].

Festinger's second hypothesis appears to create ambivalence between dissonance concept and theory. Conceptually, the second hypothesis would not necessarily be a corollary of the first in every situation. Lecky (1951) held that an individual must risk the security he desires and seek inconsistencies in order to learn and develop. Narrow interpretation of Festinger's second hypothesis could create a divergence between the results of controlled experimental studies and what actually happens in non-controlled situations.

The literature illustrates that there has been controversy over this point. In some cases people actively avoid dissonant information. Mills and Jellison (1965) found that ". . . prior to commitment people who are certain that an alternative is the best will avoid information favoring a different alternative [589]." Conversely, Freedman (1965) found that high-confident subjects prefer dissonant information while low-confident subjects prefer consonant information. Mills (1967) found that while subjects seek out dissonance reducing information, they do not avoid dissonance increasing information. Lowin's (1966) work generally supports the hypothesis that dissonant persons desire agreeable information and avoid information with which they disagree. However, he found that a person may choose to approach or refute dissonant information. The choice depends on the perceived ease of message refutation. Easily refuted messages are approached. Strong dissonant messages are avoided. And as discussed earlier, one would expect that the depth of ego-involvement would play a part in whether dissonant messages would be approached or refuted.

Apparently Festinger's (1957) second hypothesis is not necessarily a corollary of the first, and Lecky's (1951) belief that a person may choose to face dissonance has been supported.

This phenomenon may affect the present investigation. The subject material of the televised lesson could introduce a bias between the strata of ability levels. The low stratum subjects may have less confidence based on past experiences with their perceived ability to study. This would result in different perceptual distortion scores between strata depending on whether there was refutation. The term refutation in this sense is addressed to the question of whether the subjects psychologically choose to engage in or avoid a dissonant situation. Refutation would likely result in relatively more unfavorable perceptual distortion scores. Non-refutation would likely result in more favorable scores because the low ability subjects would perceive a need to know more about the subject material "How To Study." This possible bias would appear across all uniform variables for the low stratum as compared to the medium and high strata. However, it will be seen in more detail in Chapter 3 that a bias possibly created by the subject material of the televised lesson for the low ability subjects should not affect this study because the dependent variable is compared within uniform variables rather than between ability level strata; i.e., differences between strata were expected, since these ability level strata were different to begin with. Based on the experimental model, there was no intent to make comparisons between strata except by inspection. All statistical comparisons were made within treatment variables.

However, it was recognized that neither the uniform of incongruent instructors nor a possible bias of the subject material may create sufficient dissonance to render refutation and hence dissonance reduction necessary on the part of the subjects. Given the uncertainty over conditions necessary for the avoidance of dissonance, and whether or not refutation would be difficult, the alternative in this case was to develop a model which placed subjects into a possibly dissonant situation and test for differences in learning and perceptual distortion.

#### Arousal of Dissonance

In a book that reviewed investigations of cognitive dissonance theory, Brehm and Cohen (1962) speculated that two necessary conditions for the arousal of dissonance were commitment and volition.

The possible affect of commitment in this study was a matter of conjecture. According to the concepts of Lecky (1951), Osgood and Tannenbaum (1955) and Festinger (1957), it would appear obvious that commitment in terms of magnitude to self-image is a necessary a priori to dissonance. They believed that the magnitude of dissonance produced would depend on the importance of the issue to the individual. Importance of the issue would form the basis for an individual's commitment to it. Brehm and Cohen (1962) cited several studies to confirm this phenomena. And Eagly (1967) found that when information was dissonant, highly ego-involved subjects changed less toward the information and evaluated it as less accurate than did low ego-involved subjects. Therefore, the possible affect of commitment to this investigation was based on an assumption. It was assumed that identification of subjects with the Air Force would be ego-involving enough to create dissonance when

non-Air Force instructors were presented through the television medium. The experiments were designed to test this assumption. If the assumption was correct it was predicted that perceptual distortion indicates of subjects viewing television programs with incongruent instructors would be higher than the distortion indicates of those subjects who had viewed the television program in which the instructor was dressed as an Air Force technical sergeant.

According to Brehm and Cohen (1962), the second ingredient necessary for the arousal of dissonance was volition. Volition is related to the controversy over Monaghan's (1970) and Festinger's (1962) second assumption which was discussed earlier. Whether man actively avoids dissonance depends upon the situation. Brehm and Cohen (1962) reported that whether a person freely chooses to set himself into a possible dissonant situation is related to the magnitude of dissonance produced. As discussed earlier, one may assume that man is not reactive in all situations and that he does indeed voluntarily place himself in situations where he expects a certain amount of imbalance to occur. When coerced into these situations, the amount of dissonance produced appears to be decreased as opposed to dissonant situations occasioned by voluntary action. According to Lecky (1951), if man has no choice in the matter, forced situations would not necessarily create a threat to self-image. Only the individual can make this judgment. Brehm and Cohen (1962) cited several studies to demonstrate this non-obvious factor in the arousal of dissonance.

Whether volition could affect this study was a matter of interpretation. Although the subjects volunteered into the Air Force, it is

probable that because of conscription policies, many were volunteers under duress. Further, the subjects did not specifically volunteer for experimentation. The experiments were merely arranged as part of the training schedule. Conversely, one may assume that since the subjects volunteered into the Air Force, they believed the Air Force was the most attractive alternative. Further, one may assume that some subjects were predisposed toward the Air Force as a vocation and chose enlistment as something more than the best of several disagreeable alternatives. The subjects were volunteers in the sense that they enlisted into the Air Force with full knowledge that training would be a result of that action. They were non-volunteers in the sense that they did not specifically volunteer to attend the lesson on "How To Study," nor did they volunteer to be subjects in an experiment.

Certainly there was reason to believe that volition and commitment were salient factors in this study. However, it is only the personality of an individual that can determine just what is a dissonant producing condition. Theoretically it is feasible to believe that incongruent instructors could create dissonance in certain individuals. An investigation could have been designed to ferret out these individuals. But, to be meaningful in terms of the justification of the study, this investigation was designed to measure group results. If enough individual subjects became dissonant the group results would be affected. And for whatever the reasons, all individual subjects in the experimental groups of this investigation had a common identification in that they volunteered into the Air Force. Further, all subjects had recently completed the first six weeks of basic training. One objective of this

training was to instill identification or commitment to the Air Force. Theoretically, if group commitment in terms of identification with the Air Force (for which they volunteered) was great enough, incongruous instructors would produce dissonance.

#### Dissonance Reduction

Festinger (1957) suggested six dissonance reduction methods:

(1) misperceive or fail to recognize the stimulus, (2) invalidate the dissonance producing information, (3) forget the dissonance producing information, (4) change one's opinion to correspond to the dissonant information, (5) influence the person causing the dissonant condition to change his opinion to conform to yours, and (6) in interpersonal situations make the person holding the dissonant opinion not comparable to oneself.

Method number three was not considered a very strong possibility because subjects were tested immediately after having been exposed to incongruous instructors. Method number four was considered to be highly improbable because it was doubtful that subjects would be so impressed by an incongruous instructor on television that they would cognitively restructure and change identification to another branch of military service. Methods number five and number six were considered impossible since the dissonant producing stimuli was presented through a one-way television medium. Only methods number one and number two were considered appropriate to this study. Since the subjects could not physically avoid the situation, their means for dissonance reduction were limited to misperceived or invalidated information that would be reflected in the perceptual distortion indicate scores.

Evidence that perceptual distortion is a dissonance reduction technique may be inferred from a study by Brock (1966). He found that static filled radio messages were perceived differently according to an individual's involvement in the issue. Freedman and Steinbrunner (1964) found that evaluators of graduate school candidates were resistant to change their opinion about a candidate when presented with an opposite opinion by another communicator. This resistance to change on the part of the evaluator was characterized by an increased tendency to reject both the communication and the communicator rather than to distort memory or relevant information.

In this investigation subjects could reject the communicator and the message by distorting the ratings they give to the instructor, subject material and television medium on the perceptual distortion indicates referred to as analytical variables.

#### Individual Toleration of Dissonance

Festinger (1957) believed that personality differences among individuals would create differences in toleration of dissonance. Evidence to support this contention was also provided by Harvey and Ware (1967), Fillenbaum (1964) and Hunt (1968). They found that individual differences in toleration of dissonance appeared to center around a person's theoretical symbolic orientation and dogmatism or open-closed mindedness. Although there is some speculation about whether these are factors associated with sophistication rather than intelligence, the evidence did suggest the rationale for selecting the subjects of this investigation into high, medium and low ability strata.

Further, the model for this study was developed to detect differences between groups around an assumed group norm. The intent was to discover if there were differences between treatment groups rather than between individuals. Matching and randomizing procedures were utilized to average out the individual differences in that the probability of their occurrence would be approximately the same for groups within each stratum.

#### Related Studies

In addition to the previously cited literature, several studies deserve attention as being closely related to the present investigation.

Two studies have been completed in the television medium that attempted to correlate learning with measured attitude toward television instruction. The results were inconclusive.

Merrill (1956) produced an instructional television program for farmers and homemakers. After a showing he gathered attitude ratings and measured learning. He found no significant relationship between liking television instruction and learning.

Whiting (1961) compared the grades of students taught by closed-circuit television with their attitude toward television instruction. Students who were relatively neutral toward television instruction made higher grades than those who favored it. Those with positive attitudes made higher grades than those who disliked television instruction.

A tentative conclusion seems to be that a favorable attitude toward television instruction is not always necessary for effective learning. This would not be in disagreement with the theoretical basis for this investigation. According to the theory of cognitive dissonance,

an individual's dissonance reduction attempts could take many forms of observable behavior. A neutral perceptual distortion indicate score toward instructional television may mean that for an individual at least, the indicate was not relative as a dissonant producing factor. The investigation under consideration included analytical variables around three perceptual distortion indicates, i.e., television as a medium of instruction, subject material, and the instructor as a teacher. Perceptual distortion was predicted to occur around one or a combination of these indicates.

Unfortunately neither of the aforementioned studies controlled for ability levels nor did they identify a possibly dissonant producing group norm. Merrill (1956) indicated that attitudes may reflect one aspect of teaching; the learning another. The theory of cognitive dissonance would hold that attitude, perception and learning are interrelated. They could affect one another if there was a relative dissonance producing agent. In the case of this investigation, a group norm and attendant ego-involvement was predicted to render the non-Air Force instructors dissonant producing agents.

There is evidence to suggest a link between learning time and attitude. Jones and Kohler (1958) tested subjects to determine their attitudes toward segregation issues. Then the subjects were required to learn statements either in support or disagreement with their attitudes. Each set of statements included both plausible and implausible utterances. Subjects whose attitudes favored segregation learned plausible pro-segregation statements and implausible anti-segregation statements much more rapidly than plausible anti-segregation and implausible

pro-segregation statements. The reverse was true for subjects whose attitude favored desegregation. The televised lessons of this investigation were designed to present a large amount of information in a short period of time. If the subject's attitude toward incongruent instructors was negative enough it would result in perceptual distortion and decreased learning rates compared to the instructor variable that did not create dissonance.

A review of the literature indicated that this study has not been attempted prior to this date.

#### Summary

This chapter presented the theoretical foundation necessary to examine the methods of procedure, results and findings of the study that appear in the following chapters. The theory of cognitive dissonance was used as an analytical model within which to examine the questions under consideration. The data of this chapter suggested theoretical issues in terms of the experimental design and possible results.

Three issues concerned the experimental design that will be discussed in the following chapter. First, the subject material of the televised lesson may create a bias between the low ability level stratum and the medium and high ability level strata. A review of the following chapter illustrates that this possible bias should not affect this study because the experimental model was designed to measure results within the treatment or uniform variables rather than between strata. Differences should be expected between strata since they were composed of subjects differing in intelligence and aptitude scores. Second, a review of the following chapter demonstrates that the conditions of the

experimental design controlled and limited the means for dissonance reduction to perceptual distortion. The testing situation limited the ways a person would likely distort perception to three indicates. Distortion would most likely center on television as a medium of instruction, the instructor as a teacher and the subject material of the televised lesson. Third, the following chapter illustrates that matching, stratification and randomizing procedures were utilized to average out individual differences that were likely to affect this study.

The data in this chapter suggested that the principle theoretical issue in terms of experimental results was whether the assumed group norm was ego-involved enough to create dissonance in what may be considered a non-voluntary testing situation. Whether the dissonance as suggested by the perceptual distortion indicates would be sufficient to create learning differences was the critical concern of the investigation.

## Chapter 3

### METHOD OF PROCEDURE

#### Introduction

The purpose of this chapter is to present the experimental model and methods of procedure. A secondary purpose is to present the model and procedures in context with the process of inquiry. In keeping with these purposes the chapter is divided into the following areas:

First, the statement of the problem and the proposition and its explanation are re-stated as part of this introduction. This should serve as a review of the terminology and theoretical background contained in previous chapters.

Next, a representation of the divisions of the experimental population and the experimental model are presented. The model should serve as a reminder of two related aspects in this investigation. The representation of the two-part experimental model should remind the reader of the two-part concept that was presented in the process of inquiry near the end of Chapter 1; i.e., the possible relationship of cognitive and affective elements of learning. The representation of the model should also serve as a reminder of the necessity for the procedures to follow.

Then this chapter deals with the population study and methods of procedure in a time-patterned order with comments as necessary about the critical, practical, theoretical and design implications.

Finally, a review is provided at the end of the chapter to demonstrate that cognitive dissonance theory, the experimental model, and methods of procedure should not be conceptually compartmentalized into the format of this investigation.

Restatement of the problem. The statement of the problem is: The purpose of this study was to determine whether cognitive learning scores and perceptual distortion indicates of United States Air Force basic airmen would be affected by utilizing educational television instructors from different branches of Department of Defense services.

Restatement of the proposition. The statement of the proposition is: Subjects viewing the Air Force Technical Sergeant instructor would learn more than their counterparts who viewed incongruent instructors not wearing the Air Force uniform. Further, subjects viewing the Air Force Technical Sergeant instructor would more favorably rate the perceptual distortion indicates than their counterparts who viewed incongruent instructors not wearing the Air Force uniform.

The explanation of the proposition in relation to theory and experimental model is: Learning would be measured by the criterion variable or group scores of the test on "How To Study." Perceptual distortion would be measured by the analytical variables or group scores on the opinion questions. The cognitive element was represented by the criterion variable. The affective element was represented by the analytical variables. The group norm (identification with the Air Force uniform) would be both relevant and strong enough to create cognitive dissonance when subjects were forced into a situation where they viewed an instructor who was

cognitively inconsistent with their expectations. Since subjects could not avoid the physical situation, congruence would be attained by perceptual distortion. Some of the psychic energy would be directed toward attaining cognitive balance rather than learning. This energy drain would be reflected in more unfavorable perceptual distortion indicates referred to as analytical variables. Other factors being equal, there would be a relationship by inspection between the perceptual distortion indicates and decreased learning in that the same subject cells would be significantly different in terms of analytical variables and the criterion variable. Differences in perceptual distortion would indicate whether dissonance was experienced by subjects within treatment variables. An assumed group norm was necessary for prediction purposes. However, differences in analytical variables within treatment variables would suggest whether there were differences in identification associated with a particular uniform and the assumed group norm could be altered accordingly.

#### Experimental Model

The experimental model called for the experimental population to be divided as follows: There were four treatment variables corresponding to the dress of the television instructor. For each treatment variable there was a treatment group consisting of ninety subjects subdivided into three ability level cells of thirty subjects each. There was a high ability cell, medium ability cell and low ability cell in each treatment group of ninety subjects. The four high ability level cells within the four treatment groups were classified as the high stratum. Therefore, each stratum consisted of 120 subjects. Adding the

three strata together the total number of experimental subjects was set at 360. These divisions of the experimental population are represented in Table 1.

The method of procedure was developed around a model represented in Table 2. The cognitive element of the concept was represented by a modified treatment by block design (Myers, 1966) to analyze differences in the criterion variable (learning) within treatment (instructor uniform) groups for each stratum. The model did not call for an analysis of the criterion variable between strata since each stratum was different to begin with.

The next analyses were concerned with the affective element. The affective element was represented by nine  $3 \times 4$  Chi Square contingency tables devised to detect differences in the analytical variables (opinion questions) within treatment (instructor uniform) groups. The series included tables for each of the three perceptual distortion indicates based on a five point Likert type scale (Kerlinger, 1964). The sequence was repeated for high, medium and low strata. Next, three analysis of variance tables were devised to test the combined perceptual distortion indicates by stratum. The combining was necessary because it had been predicted that distortion would occur around one or a combination of the perceptual distortion indicates. Further, the combining of strata was necessary to detect possible differences that were not apparent when a smaller number of subjects were used for a treatment variable. All differences in analytical variables were measured within treatment groups rather than between strata.

Table 1  
Divisions of the Experimental Population

| Treatment Variable |        |           |          |        |                |
|--------------------|--------|-----------|----------|--------|----------------|
|                    | Navy   | Air Force | Civilian | Army   |                |
| High Stratum       | n = 30 | n = 30    | n = 30   | n = 30 | n = 120        |
| Medium Stratum     | n = 30 | n = 30    | n = 30   | n = 30 | n = 120        |
| Low Stratum        | n = 30 | n = 30    | n = 30   | n = 30 | n = 120        |
|                    | n = 90 | n = 90    | n = 90   | n = 90 | <u>N = 360</u> |

Cell n = 30

Treatment Group n = 90

Stratum n = 120

Total N = 360

Table 2  
Representation of Experimental Model

Example of modified treatment by block design using one-way analyses of variance by stratum for the criterion variable.

| Strata         | Treatment Variables |           |          |      |
|----------------|---------------------|-----------|----------|------|
|                | Navy                | Air Force | Civilian | Army |
| High Stratum   | 1.1*                | 2.1       | 3.1      | 4.1  |
| Medium Stratum | 1.2                 | 2.2       | 3.2      | 4.2  |
| Low Stratum    | 1.3                 | 2.3       | 3.3      | 4.3  |

\*cell number      Cell n = 30      Treatment Group = 90      Total N = 360

Example of modified treatment by block design using Chi Square contingency table for the high stratum analytical variable (Opinion Question A, Television as a medium of instruction).

| Perceptual Distortion<br>Indicate | High Stratum by Treatment Variable |                    |                   |               |
|-----------------------------------|------------------------------------|--------------------|-------------------|---------------|
|                                   | 1.1<br>(Navy)                      | 2.1<br>(Air Force) | 3.1<br>(Civilian) | 4.1<br>(Army) |
| unfavorable (d and e)             | $f_{1.1,de}$                       | $f_{2.1,de}$       | $f_{3.1,de}$      | $f_{4.1,de}$  |
| neutral (c)                       | $f_{1.1,c}$                        | $f_{2.1,c}$        | $f_{3.1,c}$       | $f_{4.1,c}$   |
| favorable (a and b)               | $f_{1.1,ab}$                       | $f_{2.1,ab}$       | $f_{3.1,ab}$      | $f_{4.1,ab}$  |

Cell n=30      Cell n=30      Cell n=30      Cell n=30

f = frequency of occurrence for answer a,b,c,d or e.      Stratum n = 120

To read the table:

- 1) The first half of the model represents the cognitive element of the concept or differences in the learning test. Three one-way analyses of variance tested the criterion variable by stratum within treatment variable. Then the strata were collapsed and a one-way analysis of variance tested the criterion variable within treatment variables by combined strata or total treatment group.
- 2) The second half of the model is only one example of the affective element of the concept or perceptual distortion. Altogether nine chi square contingency tables were required to test the analytical variables by treatment variable. Then the frequencies were converted

to numerical scores and three analysis of variance tables tested the total analytical variable scores for each stratum within treatment variables. Then the strata were collapsed and a one-way analysis of variance tested the total analytical variable score within treatment variables by combined strata or total treatment group.

- 3) The two part model made it possible to use a simple inspection procedure to see if the same cells were different in both criterion variable (cognitive element) and in one or a combination of the analytical variables (affective element).

This model was devised to comply with the prediction that after statistical analysis, inspection would reveal that the same cells were different in learning and in one or a combination of the perceptual distortion indicates. Differences in analytical variables within treatment groups would suggest the presence of dissonance. Differences in the criterion variable within treatment groups would indicate differences in learning.

#### Population Study

Description and justification. A population study was made from a computer listing of the March 1970 personnel gains at Lowry Air Force Base (hereafter referred to as Lowry). The March personnel gains were considered representative of the potential experimental population. The individual school's selection processes combined with the large number of schools, course offerings and training times at Lowry made it probable that approximately the same kinds of subjects in terms of the subject selection criteria would enter Lowry each month.

The purpose of the population study was to establish the subject selection criteria for the experimental population. More specifically, this meant that the population study was used to (1) determine whether the proposed matching criteria were feasible, and (2) establish the stratifying criteria for the experimental population.

The reason for stratifying subjects was to provide high, medium and low ability strata because the review of the literature indicated there was reason to believe that dissonance arousal was related to

individual toleration of dissonance according to an ability factor such as intelligence.

The reason for matching subjects was to insure that the experimental population was homogeneous. A homogeneous population and an adequate size N were considered critical since the one time availability of subjects and the possibility of contamination precluded a pre-test/post-test design.

Subject selection criteria that governed matching and stratifying procedures helped insure that experimental cells contained homogeneous subjects within each stratum and within treatment groups. This was an attempt to impose controls on the experimental population where the statistical measurements would be critical; i.e., the individual stratum by treatment group and the combined strata by treatment group would be homogeneous. Measurement of the criterion and analytical variables would occur across (within) these treatment variables. The experimental model did not call for vertical treatment or treatment between strata. However, the design called for the combining of strata under each treatment variable. This was necessary to increase the treatment group N in the event that combined strata measurements would detect differences that were not apparent when a smaller number of subjects had been used to analyze the results of only one stratum. For example, cell sizes of thirty would create ninety homogeneous subjects for each treatment group when the high, medium and low strata cells were combined under one treatment variable.

The proposed experimental matching criteria were used in the population study. The criteria were: (a) First term male airmen who

recently completed the first portion of basic training (six weeks) and were transferred to Lowry to attend a technical training school, (b) Ages seventeen through twenty-three at the time of selection, (c) High school graduates or above, and (d) Information available to the author to serve for stratifying on the basis of ability levels.

The computer listing provided information for (d) above in the form of five percentile ranks for each student on standardized tests used throughout the Air Force. The percentile ranks were from the Armed Forces Qualification Test (intelligence) and the Airman Qualifying Examination (four aptitude clusters). The four aptitude clusters were administrative, electrical, general, and mechanical. According to Valentine (1968) the Armed Forces Qualification test (intelligence) has a reliability index of .88. The Airman Qualifying Examination (aptitude) has a composite reliability index of .88 (Vitola and Madden, 1967). According to Vitola and Alley (1968) the reliability index for the administrative, electrical, general, and mechanical aptitude clusters was .91, .91, .86 and .84 respectively. Validity indexes were not published for these tests. Hereafter test names and percentile ranks will be referred to as intelligence scores and aptitude scores respectively.

Discussion. Four hundred and forty-five airmen who entered training at Lowry during March 1970 met the proposed matching criteria. Inspection of Table 5 shows that the matched population intelligence scores were negatively skewed. Inspection of the corresponding aptitude scores, not illustrated in the table, suggested that there was little relationship between intelligence and aptitude scores for subjects

**Table 3**  
**Intelligence Percentile Ranges of the Population**  
**Study Subjects**

| AFQT Percentile Range<br>(Intelligence) | Number              |                    |
|-----------------------------------------|---------------------|--------------------|
| 83-100                                  | 148                 |                    |
| 62-83                                   | 148                 |                    |
| 10-62                                   | 149                 |                    |
| <b>N = 445</b>                          |                     |                    |
| <b><math>\bar{X} = 71.98</math></b>     | <b>Med. = 73.57</b> | <b>No. = 85.00</b> |

The percentile ranges were developed by dividing the population (445) into three groups of approximately the same size (148) around the median. These intelligence percentile ranges eventually became the high, medium and low stratifying ranges of the experimental population.

Negative skewness is illustrated by (1) the non-proportional percentile ranges for equivalent numbers of subjects in each range, and (2) inspection of the mean, median and mode.

falling in the ten through thirty range in intelligence scores. Beyond the ten through thirty intelligence score range there appeared to be a close relationship between intelligence and aptitude scores.

Reason for the skewness of intelligence scores and the relationships between intelligence and aptitude scores for the ten through thirty range may be found in the selection process for the Lowry training schools. Airmen are selected for entry into the Air Force on the basis of intelligence scores. However, the technical training centers determine the aptitude score ranges required for each school. Most of the Lowry schools only enter students with average and above average aptitude scores.

Intelligence ranges between ten and thirty represent Project One Hundred Thousand airmen. This program was instituted by Presidential directive to require the military services to accept and train a group of people who had previously been excused from service because of unacceptable intelligence scores. Possibly because of recruiting policies, most aptitude scores for these people were considerably higher than the corresponding intelligence scores. The aptitude scores ranged as high as the eightieth percentile, while the upper limit for the corresponding intelligence scores that were examined was the thirtieth percentile.

A reason for these differences for the ten through thirty percentile ranges may be attributable to the small quotas for Project One Hundred Thousand in combination with policies that allowed recruiters to take only the best of this group; i.e., those who scored low on intelligence but had the highest aptitude scores. There was the possibility that some recruiters who had already filled their regular quotas and had

some unfilled slots in the Project One Hundred Thousand quota could influence potential enlistees to score low on intelligence so they could be inducted into the Air Force. If these assumptions were true, they could account for the high aptitude scores of many students who had scored ten through thirty percentile range in intelligence. As a result of these factors it was decided to make aptitude scores a main effect in the intelligence stratification criteria to be established for the experiments. The addition of aptitude scores to any basic intelligence stratifying criteria was an attempt to eliminate intelligence score error while helping to insure that the low stratum would actually consist of subjects with valid intelligence scores; i.e., subjects who were expected to score low on the intelligence test.

The next phase of the population study focused on the stratification possibilities. Various combinations of intelligence and aptitude score clusters were examined in an attempt to find an efficient method for stratification. Stratification efficiency became a matter of judgment in terms of adding a reasonable number of the four available aptitude scores to a basic intelligence score range while preserving as much of the matched population as possible. It was a matter of judgment because the basic stratification ranges were formed by intelligence score ranges around a point near the intelligence score median. Thus all intelligence scores of the matched population would fall into one of the stratifying ranges. To reduce possible invalid intelligence scores and intelligence score error it was desired that the aptitude scores of an individual fall within the same stratum percentile range as the intelligence score. This procedure would create losses because some of the

aptitude scores would invariably be outside the appropriate intelligence score ranges. This would mean that those matched students would not qualify as subjects according to a proposed stratifying criteria. Although a potential subject may meet the matching criteria he would be lost because he did not qualify under a stratifying criteria. For example, if a person who met the matching criteria had an intelligence score of thirty, he would fall into the low stratum range of ten through sixty-two. His four aptitude cluster scores were thirty-five, forty-five, sixty-five and seventy. If the stratification criteria required that all four aptitude scores fall into the same range, he would not qualify. Therefore he would not become an experimental subject although he had met the matching criteria. However, if the stratification criteria had required that only two of the four available aptitude scores be in the intelligence score range the student would have qualified to be an experimental subject.

As a result of trying various stratifying procedures, a judgment was made and the final criteria was set. The decision criteria eliminated 30 percent of the matched subjects in the population study. It became the subject selection criteria for the investigation. These criteria are discussed in detail below.

#### Subject Selection Criteria

As a result of the population study all experimental subjects of this investigation were required to meet the subject selection criteria. Qualification as a subject involved a two step process. Potential subjects were required to meet both a matching and a stratifying criteria. Failure to meet either resulted in disqualification.

The matching criteria were: (a) First term male airmen who recently completed the first portion of basic training and were transferred to Lowry to attend a technical training school, (b) Ages seventeen through twenty-three at the time of selection, (c) High school graduates or above, and (d) Percentile rank available to the author on the Armed Forces Qualification Test (intelligence) and the Airman Qualifying Examination (four aptitude clusters).

The stratifying criteria were: (a) An intelligence score in range ten through sixty-two, sixty-two through eighty-three, or eighty-three through one hundred to place the potential subject into the low, medium or high stratum respectively, (b) Two or more of the four available aptitude scores in the basic intelligence score range, and (c) If the intelligence score was at a cut off point of sixty-two or eighty-three, the highest number of aptitude scores in a stratification range became the final determiner of which stratum the subject would be placed into. Two aptitude scores in two different intelligence strata ranges resulted in disqualification; i.e., the student would not be used as a subject in the experiments to follow.

#### The Lesson

The topic of the televised lesson was "How To Study." This subject was chosen for several reasons. The investigation called for the subject material to be neutral in terms of the treatment variables. This subject, "How To Study," did not appear to present inherent biases within treatment variables such as might occur in a topic that reviewed the theory associated with underwater depth sounding equipment or how to

fire a mortar. These topics would be biased toward a treatment variable; i.e., the Navy instructor uniform and the Army instructor uniform respectively. Such topics would not be neutral. The subject matter also had to be acceptable to the Lowry Technical Training Center, and this was one of the topics their consultants suggested as being useful and a common requirement in all technical training schools. Finally, since only a post test was to be administered, the subject material should be on a topic unfamiliar to the subjects as a formal discipline so as not to create biases through differences in experience disassociated from the basic stratification criteria of intelligence.

The subject material on "How To Study" appeared to be an acceptable alternative although it could possibly create a bias among the low stratum subjects because of their past and possibly disagreeable experiences with study. However, this was discounted because there were to be no measurements for differences in the criterion and analytical variables between strata. The measurements would occur within treatment variables, and as such, the possible bias would be averaged out for each cell in the low stratum.

There was a similar reason for discounting the possibility that subjects could have prior experience with "How To Study" as a formal course. Even if a few of the subjects had experienced a formal course in "How To Study," theoretically the cell sizes, matching, stratifying and randomizing procedures incorporated into this investigation would dictate that these experimental subjects should be relatively evenly distributed within the treatment groups. Therefore any differences they created would be approximately the same for each treatment variable.

And the measurements for differences in criterion and analytical variables would only occur within these treatment variables.

Appendix A provides detailed data on the televised lesson script. The first part of the lesson was taken from the Ebbinghaus curve of retention as described by Kelly (1965:230-231) and distributive reinforcement from an Air University publication Studying To Learn (1955:28). The second part of the lesson, principles of learning, were modified and paraphrased from Kelly's (1965:214-217) review of the Thorndike laws of learning. The third part of the lesson, the 3 R system of learning through reading, was taken from the Air University publication Studying To Learn (1955:1-9). Illustrations and examples of application were created by the author to comply with the lesson goals. Bloom (1956:62-143, 201-205) and Mager (1962:1-60) were the references used as a guide in developing the lesson goals and desired learning objectives.

#### Television Production

The television lessons were produced on two-inch black and white video tape at the United States Air Force Academy between July 8 and July 30, 1970. The director, instructor and crew members were aware that if conflicts developed between control and good production techniques, control was the critical factor. Control was necessary to insure that there were no differences within the four television programs except for the uniform of the instructor. The author was present in the capacity of producer during all stages of production. The same lighting, set, cameras, camera angles, lens openings, sound levels, script, graphics, and primary crew were used for each lesson. Portions of the script not requiring the appearance of the instructor on camera

were edited into each lesson from a master tape. The length of the programs varied from twenty-one minutes thirty seconds to twenty-one minutes fifty-eight seconds.

The sequence of production was randomized from tables in Arkin and Colton (1966:158-161). The order of production by uniform of the instructor was Army Staff Sergeant, Air Force Technical Sergeant, Civil Service employee, and Navy Petty Officer First Class. The production with the Army Staff Sergeant instructor variable was used as the master tape. Complete details of the television production are included in Appendix A.

#### Test Instrument Development

The test instrument was divided into two sections. The first part contained the opinion questions that represented the affective element of the concept (Appendix B). These questions were in the form of three opinion questions to be answered on a five point Likert type scale. The questions were designed to measure subject opinion on (1) Television as a medium of instruction, (2) The instructor as a teacher, and (3) The subject material of the televised lesson on "How To Study." The Likert type scale provided five choices for each question. In each question the choices ranged from a very positive through a neutral to a very negative response. Only three questions were provided. A review of the three opinion questions above will reveal that they were appropriate to factors inherent in the experimental environment to which the subjects were exposed. It seemed apparent that as a result of the incongruent instructor uniforms, there could be no other reasonable aspects of the

experimental environment that the subjects were likely to distort perception on. The opinion questions are provided in Appendix B.

The second part of the test instrument contained the test items on the subject material of the televised lesson. This represented the cognitive element of the concept. The description below is concerned only with the portion of the test instrument designed for the subject material on "How To Study." A detailed test development description is contained in Appendix C.

A fifty-eight item test was constructed using the television script and learning objectives as a guide. This original test was administered to 170 airmen on July 17 and 20, 1970 after they had viewed the televised lesson with the instructor dressed in the Air Force technical sergeant uniform. Then subjects were post-matched and post-stratified according to the subject selection criteria described on pages 47 and 48 of this study. As a result of this test development run, the procedures were altered so that only pre-matched and pre-stratified subjects were used in later experiments. The possible results of this procedural change will be discussed in the final chapter. All other conditions were identical to those described for the experiments elsewhere in this chapter. Of the 170 airmen who viewed the television lesson and took the test, there were 109 subjects who met the subject selection criteria. There were forty, thirty-six, and thirty-three subjects respectively in the high, medium and low strata. Each stratum was reduced to thirty by random discard (Arkin and Colton, 1966). These subjects were used only once for test development purposes and did not later become part of an experimental group.

The item analysis was completed using the ITEMANA program on the Burroughs 5500 computer at the United States Air Force Academy. The analysis included a reliability coefficient using the Kuder-Richardson formula number twenty (Thorndike and Llagnen, 1961). This is similar to the split-halves method for inter-item consistency in that the reliability is found from a single administration of a single test. According to Anastasi (1968):

It can be shown mathematically that the Kuder-Richardson reliability coefficient is actually the mean of all split-half coefficients resulting from different splittings of a test. The ordinary split-half coefficient, on the other hand, is based on a planned split designed to yield equivalent sets of items. Hence, unless the test items are highly homogeneous, the Kuder-Richardson coefficient will be lower than the split-half reliability [85].

The final test used in the experiments that followed contained forty-two items. The lesson goals were not modified. The aggregate reliability estimate for the ninety test development subjects was .859. The corresponding raw score mean was 22.29. Reliability estimates for the high, medium and low strata were .787, .739 and .778 respectively. The respective raw score means for the strata were 28.33, 21.53 and 11.27.

Validity was not measured against an external test. Evidence that the test was valid was provided by four sources.

First, the script was constructed from the lesson goals. Then the test items were constructed from desired learning objectives that logically followed the lesson goals and script. This represented an attempt to incorporate content validity into the test items.

Next, the ITEMANA computer program calculated an estimate of the theoretical test validity ceiling. Statistically, the validity

coefficient cannot exceed the square root of the reliability coefficient. The maximum theoretical validity coefficient for the aggregate test was .927.

Third, the individual item point biserial correlations and their corresponding t-ratios provide an indication of item validity. Table 19, Appendix C, illustrates that all of the forty-two individual item t-ratios were significant at or above the .05 level of confidence.

Fourth, statement 2, Appendix C, provides evidence of face validity. This statement was made by the two instructors responsible for developing and teaching the "How To Study" course at the Air Force Academy. They provided expert opinion that the test was valid.

More complete details of test development are provided in Appendix C.

#### Testing Procedures

Background information. One of the requirements of the subject selection criteria was that the only subjects to be used for testing were first term male airmen who recently completed the first portion of basic training (six weeks) and were transferred to Lowry to attend a technical training school. These subjects were selected from the new student population as they arrived at Lowry. These new students and their personnel records arrived at Lowry every Sunday, Tuesday and Thursday evenings. New students were housed together and conducted through in-processing and other details for approximately three days. Then they were moved to more permanent quarters appropriate to the particular technical school they were scheduled to attend. The

experiments were conducted during this in-processing period of time on the mornings after the new students arrived at Lowry. The experimental population consisted entirely of these new students who met the subject selection criteria. All experiments were conducted from 10:45 until 12:00 noon every Monday, Wednesday and Friday.

The possibility of contamination created by communication between potential subjects and airmen who had already been subjects in an experiment was unlikely. The nature of the experiments was known only to senior officials of the organization to which the incoming students were assigned. New students were not housed with subjects who had previously viewed one of the television programs and taken the test. These factors coupled with a busy schedule made it unlikely that there was any contamination created by communication between potential subjects and students who had already been exposed to an experiment. The nature of subject questions during testing and several follow-up discussions with appropriate officials convinced the author that the subjects had no prior knowledge of the nature of the experiments.

Procedures for subject selection. Subjects were selected by an analysis of the personnel records of new students who had arrived at Lowry on the previous evening. The analysis of records and subject selection occurred on the same morning that an experiment was to be conducted. Pertinent data such as intelligence and aptitude cluster scores from the records of students who met the subject selection criteria were recorded on special test forms supplied by the Air Force Academy. These forms were made to be used on the Air Force Academy optical scanning machine. Codes were added to each subject's form to

indicate the treatment variable and high, low or medium stratum. This became the first two digits of what eventually would be a four digit subject identification number. A list of the names of the qualified subjects was delivered to an official who scheduled the subjects for experimentation later that same morning. A typical test day consisted of a showing of one of the television programs to from seventeen to forty airmen who met the subject selection criteria. The subjects were divided into high, medium and low ability strata of approximately equal numbers. The test was administered immediately after the television lesson.

Procedures for testing. All experiments occurred in building 903, room 110 at Lowry. This was a 23 X 52 foot rectangular room that was normally used for testing fairly large groups of students. Four matched 21-inch television sets (Conrac model CFB-21) were installed and spaced for comfortable viewing by as many as one hundred subjects. To render as little difference as possible between the quality of presentation from experiment to experiment an engineer tuned the audio and visual output of the program scheduled for that day. Then the program tape would be cued and made ready for a showing before the subjects arrived for testing.

The sequence of the television program treatment variables were randomized (Arkin and Colton, 1966) for each of the three testing days of the week. The population study had indicated that two months would provide an adequate number of matched and stratified subjects in each treatment group (90 each). Therefore the randomized projection for each test day was extended on the calendar for two and one-half months. Only one program or treatment variable was shown each test day. The typical

group consisted of approximately seventeen through forty subjects rather evenly divided into high, medium and low ability levels.

To comply with the assumed group norm, the author monitored all experiments in the uniform of an Air Force technical sergeant. Prior to each showing of the program, subjects were informed that neither the nature of the program nor its purpose could be divulged until after the lesson. Subjects were merely told that the program would be self-explanatory, that it lasted twenty-one minutes and the content should be remembered.

When the program was completed, coded test forms were distributed. The name of each subject had previously been placed on the form. The monitor explained that all technical schools had a common requirement for a block of instruction on how to study. The program the students had recently viewed satisfied that requirement. The program was also part of a series of lessons the Department of Defense audio visual services had prepared as a pilot program to (1) determine audience reaction and (2) develop a valid and reliable test for the instructional material. If results of the pilot series were favorable the subject material would be developed into a standard instructional television program for common use throughout the Department of Defense.

Then the monitor explained the directions for taking the test and indicated there was no time limit. Students were allowed to leave the room individually as they finished the test.

Procedures for compiling data. After experimentation the perceptual distortion indicates from the three opinion questions were read and then the scores were placed on each test form by hand. Highly positive

reactions were coded five. Mildly positive reactions were coded four. Neutral opinions were coded three. Mildly negative reactions were coded two. Highly negative reactions were coded one. Then the three question total was added and the total placed on the test form by hand. This procedure was repeated for every test form that had been used during that day's experiment.

Next, on each form a two digit sequence number was added to the treatment variable and strata code that had been placed on the form earlier that morning. This four digit code became the student identification number. A running total of the number of subjects tested by treatment variable, strata and sequence number was maintained until all cells of a treatment variable were filled. This was necessary because it signified the end of experimentation for that treatment variable. The design called for a minimum of ninety subjects in each treatment group evenly divided into a high, medium and low ability cell. The treatment group was filled when all cells contained at least thirty-three subjects. Each cell was then reduced to thirty by randomly discarding the appropriate number of test forms (Arkin and Colton, 1966). An optical scanning machine at the Air Force Academy transferred the data from test forms to computer cards. From the cards, a computer listing was made to provide the perceptual distortion indicate data from which the Chi Square contingency tables were calculated. The cards were used again to provide input to a computer program to analyze the criterion variable in terms of treatment variables by stratum and combined strata. Then the cards were used a final time to provide input to a computer program to analyze the combined analytical variables by stratum and combined strata.

Testing procedures summary. Experiments began August 3, 1970 and ended September 22, 1970. The beginning and ending times of the experiments did not vary by more than fifteen minutes. A total of 419 subjects were tested from a population of 443 qualified subjects. This represented approximately 94 percent of the incoming students who qualified as subjects during the time in which experiments were conducted. Twenty-four qualified subjects did not arrive for the scheduled tests. These losses were unavoidable and were in no way caused by the independent or treatment variables.

#### Review

The primary purpose of this chapter was to present the experimental model and procedures. A secondary purpose was that the experimental model and procedures be presented in context with the process of inquiry and format of this report. In this manner the reader would be prepared to read the following chapter with some understanding of what the results could mean in terms of the practical, theoretical and design considerations of this investigation. With these purposes in mind some critical issues of this chapter will be reviewed in context with information from previous chapters.

The intent of the experimental model was that it be designed to test for the practical and theoretical factors discussed previously under justification for this investigation. The practical considerations were focused on whether the design would adequately treat for differences associated with the incongruous instructor uniforms. The theoretical considerations were similar and included the task of determining whether the design would treat for a suggestion of dissonance

and whether a decrease in learning was associated with any groups experiencing that dissonance.

For these reasons the model was constructed in two parts. The first part was about the cognitive element of the concept. It revolved around the learning test and criterion variable to test for differences in learning associated within the treatment variables consisting of different instructor uniforms. The second part of the model was created to treat for the affective element of the concept. It revolved around the opinion questions, the results of which were broken down into component parts called perceptual distortion indicates. The group results of these questions became the analytical variables. They too were designed to test for differences associated within treatment variables. However, rather than testing for learning differences, the analytical variables were constructed to test for group differences in perceptual distortion.

While the experimental model was to be consistent with the practical and theoretical concerns, the procedures were intended to be consistent with the experimental model. None of these components could really be separated because of their interaction with each other. Nevertheless in this chapter it was necessary to compartmentalize so they could be discussed with precision. The following discussion is about some of these interacting components.

An example of interacting components may be illustrated from the fact that complete details of the experimental model were held in abeyance until the results of the population study indicated an appropriate means of stratifying and statistical analysis. A desire was that

the model not require sophisticated statistical treatment. The end result was that although the statistics used were common enough, the number of individual treatments was large and the model complicated by the necessity for combining strata with four treatment variables. The review of the literature suggested that stratifying was necessary because there was reason to believe that individual toleration of dissonance may be associated with some ability factor such as intelligence. This was a theoretical factor. Also, the practical considerations dictated the design be concerned with group results. Therefore the necessity to stratify created a problem regarding the number of subjects to place in a treatment group. The group size for each treatment variable was set at ninety. This would have been more than adequate for a non-stratified design. But ninety subjects were necessary to render a cell size of thirty for each stratum in a treatment group. It was believed that thirty subjects would be an adequate but minimum cell size if other factors of the design were carefully controlled. These cell sizes and treatment group numbers would render an investigation that could test for differences in analytical and criterion variables by ability level stratum as well as by combined strata.

The suspicion about invalid low intelligence scores presented a statistical treatment problem around the criterion variable. Invalid intelligence scores would render analysis of covariance using an intelligence score as a covariant also invalid. The addition of aptitude score covariants would wash out some of these differences. However, the intelligence scores would still be invalid. In order to insure against invalid intelligence scores, the aptitude scores could be compared with

the individual's intelligence score before the students were tested. If the relationship was fairly close, the intelligence score would probably be valid. No doubt this comparison and selection of subjects could have been done by a computer process. However the short time when records and subjects were available prevented any kind of a computer analysis selection process before testing. It appeared the amount of real time spent would be about the same for manual pre-selection as computer post-selection processes. The pre-selection process had the added advantage that the only subjects who would be tested met the subject selection criteria. Post-selection would have required mass testing of all new students as they arrived at Lowry.

The decision to use aptitude scores as a main effect in the intelligence strata rendered analysis of covariance for the criterion variable unnecessary. This was because the stratifying procedures tended to insure valid intelligence scores while accomplishing approximately the same end result as an analysis of covariance that used the intelligence and aptitude scores as covariants. In order to be sure of this effect, the treatment groups could be statistically tested for equivalency after experimentation. If they were essentially equal, analysis of variance would be used. If they appeared to be different, the statistical treatment would be changed to an analysis of covariance.

The final interaction process to be re-emphasized is the relationship between a theoretical issue, the subject matter of the televised lesson, and the experimental model. According to cognitive dissonance theory, it became a matter of conjecture whether sufficient conditions for the arousal of dissonance would be present in this investigation.

Factors could have been introduced to increase the chance of dissonance arousal. But it was believed that these factors would either have violated the practical considerations so as to render the investigation artificial, while at the same time possibly contaminating the design of the experimental model. For example, the introduction of a biased lesson topic within treatment variables would have increased the possibility of dissonance arousal. The instructors could have taught a subject peculiar to the Air Force. This would increase the chance of dissonance arousal associated with incongruent instructors. However, then the question would arise as to whether the lesson topic or the incongruent instructor uniforms created the dissonance. There would have been no way to test for the answer to this question in the experimental design of this investigation.

In this section some of the interacting practical, theoretical and design considerations were reviewed to remind the reader of the broader concepts of this investigation before reading the experimental hypotheses and results in Chapter 4.

## Chapter 4

### RESULTS

#### Treatment Group Equivalency

A discussion near the end of Chapter 3 explained why the stratifying procedures probably rendered analysis of covariance for the criterion variable unnecessary. In order to be sure of this effect, the treatment groups could be statistically tested for equivalency after experimentation. If the treatment groups were essentially equal, analysis of variance rather than analysis of covariance would be used to test the criterion variable.

To answer the question it was hypothesized that matching, stratifying and randomizing procedures provided equivalent treatment groups in terms of intelligence scores. This first analysis should not be confused with the statements of the experimental hypotheses and analyses that appear in the remainder of this chapter. This first analysis merely determined whether there was statistical support for the conjecture that the treatment groups were homogeneous in terms of intelligence scores. The intelligence scores that were used to stratify the subjects provided the dependent variable to test for heterogeneity.

The null hypothesis was: There is no difference in intelligence scores by treatment groups within the instructor treatment variables. The treatment group means and analysis of variance using intelligence scores as dependent variables is provided in Table 4. The null

Table 4  
Analysis of Variance to Test Equivalency of Treatment Groups

| Treatment Group | Number | I.Q.  |       |          |
|-----------------|--------|-------|-------|----------|
|                 |        | Mean  | S.D.  | Variance |
| Navy            | 90     | 67.11 | 25.28 | 639.27   |
| Air Force       | 90     | 67.18 | 25.11 | 630.64   |
| Civilian        | 90     | 66.50 | 26.46 | 700.43   |
| Army            | 90     | 65.10 | 28.60 | 818.43   |

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Square | F-Ratio |
|---------------------|----------------|--------------------|-------------|---------|
| Between Groups      | 251.08         | 3                  | 83.69       | .12 NS  |
| Within Groups       | 248200.64      | 356                | 697.19      |         |
| Totals              | 248451.72      | 359                |             |         |

The independent variable is the treatment group.

The dependent variable is the intelligence score.

Critical Value of .05 F df 3,356 = 8.54

hypothesis was accepted in that no significant differences were found in intelligence scores within treatment groups from one-way analyses of variance (Burroughs Corporation, 1969). As a result of this finding, analysis of variance was used for the first part of the experimental model or for all experimental hypotheses concerned with the criterion variable.

### Review

Before proceeding to the experimental hypotheses and analyses, a review is provided to remind the reader of the purpose of these analyses and to serve as a reference point for the numerous tables that follow.

The review consists of a restatement of the problem and a restatement of the proposition. It ends with copies of two tables which were previously illustrated in Chapter 3. These tables should be particularly useful to refer to as the reader proceeds through the numerous analyses constructed for each experimental hypothesis. The first table shows how the experimental population was divided into various treatment groups, strata and cells. It should prove to be an aid to understanding the second table that deals with the experimental model.

The titles of the tables are "Divisions of the Experimental Population" and "Representation of the Experimental Model." They may be located by referring to Table 5 and Table 6.

Restatement of the problem. The purpose of this study was to determine whether cognitive learning scores and perceptual distortion indicates of United States Air Force basic airmen would be affected by

**Table 5**  
**Divisions of the Experimental Population**

|                |  | Treatment Variable |           |          |        |                |
|----------------|--|--------------------|-----------|----------|--------|----------------|
|                |  | Navy               | Air Force | Civilian | Army   |                |
| High Stratum   |  | n = 30             | n = 30    | n = 30   | n = 30 | n = 120        |
| Medium Stratum |  | n = 30             | n = 30    | n = 30   | n = 30 | n = 120        |
| Low Stratum    |  | n = 30             | n = 30    | n = 30   | n = 30 | n = 120        |
|                |  | n = 90             | n = 90    | n = 90   | n = 90 | <u>N = 360</u> |

**Cell n**                   = 30

**Treatment Group n** = 90

**Stratum n**               = 120

**Total N**               = 360

Table 6  
Representation of Experimental Model

Example of modified treatment by block design using one-way analyses of variance by stratum for the criterion variable.

| Strata         | Treatment Variables |           |          |      |
|----------------|---------------------|-----------|----------|------|
|                | Navy                | Air Force | Civilian | Army |
| High Stratum   | 1.1*                | 2.1       | 3.1      | 4.1  |
| Medium Stratum | 1.2                 | 2.2       | 3.2      | 4.2  |
| Low Stratum    | 1.3                 | 2.3       | 3.3      | 4.3  |

\*cell number    Cell n = 30    Treatment Group = 90    Total N = 360

Example of modified treatment by block design using Chi Square contingency table for the high stratum analytical variable (Opinion Question A, Television as a medium of instruction).

| Perceptual Distortion<br>Indicate | High Stratum by Treatment Variable |                     |                     |                     |
|-----------------------------------|------------------------------------|---------------------|---------------------|---------------------|
|                                   | 1.1<br>(Navy)                      | 2.1<br>(Air Force)  | 3.1<br>(Civilian)   | 4.1<br>(Army)       |
| unfavorable (d and e)             | f <sub>1.1,de</sub>                | f <sub>2.1,de</sub> | f <sub>3.1,de</sub> | f <sub>4.1,de</sub> |
| neutral (c)                       | f <sub>1.1,c</sub>                 | f <sub>2.1,c</sub>  | f <sub>3.1,c</sub>  | f <sub>4.1,c</sub>  |
| favorable (a and b)               | f <sub>1.1,ab</sub>                | f <sub>2.1,ab</sub> | f <sub>3.1,ab</sub> | f <sub>4.1,ab</sub> |

Cell n=50    Cell n=30    Cell n=30    Cell n=30

f = frequency of occurrence for answer a,b,c,d or e.    Stratum n = 120

To read the table:

- 1) The first half of the model represents the cognitive element of the concept or differences in the learning test. Three one-way analyses of variance tested the criterion variable by stratum within treatment variable. Then the strata were collapsed and a one-way analysis of variance tested the criterion variable within treatment variables by combined strata or total treatment group.
- 2) The second half of the model is only one example of the affective element of the concept or perceptual distortion. Altogether nine chi square contingency tables were required to test the analytical variables by treatment variable. Then the frequencies were converted

to numerical scores and three analysis of variance tables tested the total analytical variable scores for each stratum within treatment variables. Then the strata were collapsed and a one-way analysis of variance tested the total analytical variable score within treatment variables by combined strata or total treatment group.

- 3) The two part model made it possible to use a simple inspection procedure to see if the same cells were different in both criterion variable (cognitive element) and in one or a combination of the analytical variables (affective element).

utilizing educational television instructors from different branches of Department of Defense service.

Restatement of the proposition. Subjects viewing the Air Force Technical Sergeant instructor would learn more than their counterparts who viewed incongruent instructors not wearing the Air Force uniform. Further, subjects viewing the Air Force Technical Sergeant instructor would more favorably rate the perceptual distortion indicates than their counterparts who viewed incongruent instructors not wearing the Air Force uniform.

#### Experimental Hypotheses

Learning. The first null hypothesis was concerned with the first half of the experimental model. The null hypothesis was: There is no difference in cognitive learning scores within instructor treatment variables by ability level stratum and by the total of all strata. The null hypothesis was accepted in that one-way analyses of variance (Burroughs Corporation, 1969) showed no significant differences in the test instrument scores (dependent variable) within instructor treatment (independent variable) groups. These analyses are shown in Tables 7 through 10.

Perceptual distortion: single questions. The second null hypothesis was concerned with the second half of the experimental model. A series of Chi Squares were used to test the group results of each of the three opinion questions by each stratum within treatment variables. A single table shows the results of each of the three questions in a stratum.

Table 7  
Analysis of Variance to Test Learning Differences:  
High Stratum

| Treatment Group | Number | Test  |      |          |
|-----------------|--------|-------|------|----------|
|                 |        | Mean  | S.D. | Variance |
| Navy            | 30     | 29.40 | 4.54 | 20.59    |
| Air Force       | 30     | 30.20 | 5.46 | 29.82    |
| Civilian        | 30     | 28.80 | 5.79 | 33.55    |
| Army            | 30     | 31.37 | 4.86 | 23.62    |

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Square | F-Ratio |
|---------------------|----------------|--------------------|-------------|---------|
| Between Groups      | 110.82         | 3                  | 36.94       | 1.37 NS |
| Within Groups       | 3119.77        | 116                | 26.89       |         |
| Totals              | 3230.59        | 119                |             |         |

The independent variable is the treatment group.

The dependent variable is the test score.

Critical Value of .05 F df 3,116 = 8.55

Table 8  
Analysis of Variance to Test Learning Differences:  
Medium Stratum

| Treatment Group | Number | Test  |      |          |
|-----------------|--------|-------|------|----------|
|                 |        | Mean  | S.D. | Variance |
| Navy            | 30     | 24.17 | 5.54 | 30.70    |
| Air Force       | 30     | 25.17 | 6.59 | 43.39    |
| Civilian        | 30     | 25.37 | 4.92 | 24.24    |
| Army            | 30     | 25.33 | 5.10 | 25.95    |

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Square | F-Ratio |
|---------------------|----------------|--------------------|-------------|---------|
| Between Groups      | 29.03          | 3                  | 9.68        | .31 NS  |
| Within Groups       | 3603.97        | 116                | 31.07       |         |
| Totals              | 3632.99        | 119                |             |         |

The independent variable is the treatment group..

The dependent variable is the test score.

Critical Value of .05 F df 3,116 = 8.55

Table 9  
Analysis of Variance to Test Learning Differences:  
Low Stratum

| Treatment Group | Number | Test  |      |          |
|-----------------|--------|-------|------|----------|
|                 |        | Mean  | S.D. | Variance |
| Navy            | 30     | 18.03 | 6.08 | 37.00    |
| Air Force       | 30     | 18.20 | 4.75 | 22.51    |
| Civilian        | 30     | 18.17 | 5.13 | 26.28    |
| Army            | 30     | 20.23 | 6.22 | 38.67    |

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Square | F-Ratio |
|---------------------|----------------|--------------------|-------------|---------|
| Between Groups      | 99.69          | 3                  | 33.23       | 1.07 NS |
| Within Groups       | 3609.30        | 116                | 31.11       |         |
| Totals              | 3708.99        | 119                |             |         |

The independent variable is the treatment group.

The dependent variable is the test score.

Critical Value of .05 F df 3,116 = 8.55

**Table 10**  
**Analysis of Variance to Test Learning Differences:**  
**All Strata**

| <b>Treatment Group</b> | <b>Number</b> | <b>Test</b>  |             |                 |
|------------------------|---------------|--------------|-------------|-----------------|
|                        |               | <b>Mean</b>  | <b>S.D.</b> | <b>Variance</b> |
| <b>Navy</b>            | 90            | <b>23.87</b> | <b>7.11</b> | <b>50.59</b>    |
| <b>Air Force</b>       | 90            | <b>24.52</b> | <b>7.46</b> | <b>55.67</b>    |
| <b>Civilian</b>        | 90            | <b>24.11</b> | <b>6.87</b> | <b>47.25</b>    |
| <b>Army</b>            | 90            | <b>25.64</b> | <b>7.05</b> | <b>49.69</b>    |

| <b>Sources of Variation</b> | <b>Sum of Squares</b> | <b>Degrees of Freedom</b> | <b>Mean Square</b> | <b>F-Ratio</b> |
|-----------------------------|-----------------------|---------------------------|--------------------|----------------|
| <b>Between Groups</b>       | <b>167.16</b>         | <b>3</b>                  | <b>55.72</b>       | <b>1.10 NS</b> |
| <b>Within Groups</b>        | <b>18084.37</b>       | <b>356</b>                | <b>50.80</b>       |                |
| <b>Totals</b>               | <b>18251.53</b>       | <b>359</b>                |                    |                |

The independent variable is the treatment group.

The dependent variable is the test score.

Critical Value of .05 F df 3,356 = 8.54

The null hypothesis was: There is no difference in perceptual distortion indicate frequencies within instructor treatment groups by ability level stratum. The null hypothesis was accepted in that a series of Chi Square contingency tables showed no significant differences in perceptual distortion indicate frequencies (dependent variable) within instructor treatment (independent variables) groups. This series of analyses are shown in Tables 11 through 13.

Perceptual distortion: combined questions. The third null hypothesis was concerned with the second half of the experimental model. A series of one-way analyses of variance (Tables 14 through 17) were used to test the combined analytical variables by treatment variable for individual stratum and combined strata. The combined scores were created by adding the perceptual distortion scores of the three opinion questions. For example, if an individual had marked the three opinion questions in answers (a), (b) and (c) respectively, the numerical scores would be 5, 4, and 3 respectively. The combined perceptual distortion score for the individual was twelve. This combined score became a dependent variable for the hypothesis above. The statistical analyses was to test dependent variables by stratum and combined strata within the treatment variables.

The null hypothesis was: There is no difference in the total perceptual distortion indicate scores within treatment groups by ability level stratum and combined strata. The null hypothesis was accepted in that one-way analyses of variance (Burroughs Corporation, 1969) showed no difference in the combined perceptual distortion indicate scores (dependent variable) within instructor treatment (independent variable)

Table 11

Chi Square Frequencies to Test Perceptual Distortion:  
High Stratum

| Perceptual Distortion<br>Indicate                                      | Cells       |                  |                 |             |     |
|------------------------------------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                                                        | Navy<br>1.1 | Air Force<br>2.1 | Civilian<br>3.1 | Army<br>4.1 |     |
| <b>Indicate 1 (Test Item A): Television as a Medium of Instruction</b> |             |                  |                 |             |     |
| unfavorable (d and e)                                                  | 0 13.00     | 0 10.00          | 0 11.00         | 0 7.00      | 41  |
| neutral (c)                                                            | 0 5.00      | 0 8.00           | 0 10.00         | 0 6.00      | 29  |
| favorable (a and b)                                                    | 0 12.00     | 0 12.00          | 0 9.00          | 0 17.00     | 50  |
|                                                                        | 30          | 30               | 30              | 30          | 120 |

Critical value .05  $\chi^2$  df 6 = 12.59       $\chi^2 = 6.50$  NS

| Perceptual Distortion<br>Indicate                            | Cells       |                  |                 |             |     |
|--------------------------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                                              | Navy<br>1.1 | Air Force<br>2.1 | Civilian<br>3.1 | Army<br>4.1 |     |
| <b>Indicate 2 (Test Item B): The Instructor as a Teacher</b> |             |                  |                 |             |     |
| unfavorable (d and e)                                        | 0 7.00      | 0 5.00           | 0 4.00          | 0 4.00      | 20  |
| neutral (c)                                                  | 0 12.00     | 0 15.00          | 0 18.00         | 0 11.00     | 56  |
| favorable (a and b)                                          | 0 11.00     | 0 10.00          | 0 8.00          | 0 15.00     | 44  |
|                                                              | 30          | 30               | 30              | 30          | 120 |

Critical value .05  $\chi^2$  df 6 = 12.59       $\chi^2 = 5.71$  NS

Table 11 (Continued)

| Perceptual Distortion<br>Indicate        | Cells       |                  |                 |             |     |
|------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                          | Navy<br>1.1 | Air Force<br>2.1 | Civilian<br>3.1 | Army<br>4.1 |     |
| Indicate 3 (Test Item C): Subject Matter |             |                  |                 |             |     |
| unfavorable (d and e)                    | 0 2.00      | 0 3.00           | 0 6.00          | 0 2.00      | 13  |
| neutral (c)                              | 0 8.00      | 0 9.00           | 0 8.00          | 0 10.00     | 35  |
| favorable (a and b)                      | 0 20.00     | 0 18.00          | 0 16.00         | 0 18.00     | 72  |
|                                          | 30          | 30               | 30              | 30          | 120 |

Critical value  $.05 \chi^2$  df 6 = 12.59 $\chi^2 = 4.07$

Table 12

Chi Square Frequencies to Test Perceptual Distortion:  
Medium Stratum

| Perceptual Distortion<br>Indicate                                      | Cells       |                  |                 |             |     |
|------------------------------------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                                                        | Navy<br>1.2 | Air Force<br>2.2 | Civilian<br>3.2 | Army<br>4.2 |     |
| <b>Indicate 1 (Test Item A): Television as a Medium of Instruction</b> |             |                  |                 |             |     |
| unfavorable (d and e)                                                  | 0 5.00      | 0 8.00           | 0 9.00          | 0 6.00      | 28  |
| neutral (c)                                                            | 0 13.00     | 0 10.00          | 0 9.00          | 0 7.00      | 39  |
| favorable (a and b)                                                    | 0 12.00     | 0 12.00          | 0 12.00         | 0 17.00     | 53  |
|                                                                        | 30          | 30               | 30              | 30          | 120 |

Critical value  $.05 \chi^2$  df 6 = 12.59       $\chi^2 = 4.77$

## Indicate 2 (Test Item B): The Instructor as a Teacher

|                       |         |         |         |         |     |
|-----------------------|---------|---------|---------|---------|-----|
| unfavorable (d and e) | 0 6.00  | 0 4.00  | 0 5.00  | 0 4.00  | 19  |
| neutral (c)           | 0 15.00 | 0 14.00 | 0 9.00  | 0 11.00 | 49  |
| favorable (a and b)   | 0 9.00  | 0 12.00 | 0 16.00 | 0 15.00 | 52  |
|                       | 30      | 30      | 30      | 30      | 120 |

Critical value  $.05 \chi^2$  df 6 = 12.59       $\chi^2 = 4.74$  NS

Table 12 (Continued)

| Perceptual Distortion<br>Indicate        | Cells       |                  |                 |             |     |
|------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                          | Navy<br>1.2 | Air Force<br>2.2 | Civilian<br>3.2 | Army<br>4.2 |     |
| Indicate 3 (Test Item C): Subject Matter |             |                  |                 |             |     |
| unfavorable (d and e)                    | 0 2.00      | 0 6.00           | 0 2.00          | 0 3.00      | 13  |
| neutral (c)                              | 0 13.00     | 0 10.00          | 0 9.00          | 0 15.00     | 47  |
| favorable (a and b)                      | 0 15.00     | 0 14.00          | 0 19.00         | 0 12.00     | 60  |
|                                          | 30          | 30               | 30              | 30          | 120 |

Critical value of .05  $\chi^2$  df 6 = 12.59 $\chi^2 = 6.98$  NS

Table 13

Chi Square Frequencies to Test Perceptual Distortion:  
Low Stratum

| Perceptual Distortion<br>Indicate                                      | Cells       |                  |                 |             |     |
|------------------------------------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                                                        | Navy<br>1.3 | Air Force<br>2.3 | Civilian<br>3.3 | Army<br>4.3 |     |
| <b>Indicate 1 (Test Item A): Television as a Medium of Instruction</b> |             |                  |                 |             |     |
| unfavorable (d and e)                                                  | 0 4.00      | 0 8.00           | 0 6.00          | 0 10.00     | 28  |
| neutral (c)                                                            | 0 10.00     | 0 10.00          | 0 11.00         | 0 10.00     | 41  |
| favorable (a and b)                                                    | 0 16.00     | 0 12.00          | 0 13.00         | 0 10.00     | 51  |
|                                                                        | 30          | 30               | 30              | 30          | 120 |

Critical value of .05  $\chi^2$  df 6 = 12.59       $\chi^2 = 4.40$  NS

| Perceptual Distortion<br>Indicate                            | Cells       |                  |                 |             |     |
|--------------------------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                                              | Navy<br>1.3 | Air Force<br>2.3 | Civilian<br>3.3 | Army<br>4.3 |     |
| <b>Indicate 2 (Test Item B): The Instructor as a Teacher</b> |             |                  |                 |             |     |
| unfavorable (d and e)                                        | 0 2.00      | 0 3.00           | 0 5.00          | 0 2.00      | 12  |
| neutral (c)                                                  | 0 12.00     | 0 13.00          | 0 5.00          | 0 14.00     | 44  |
| favorable (a and b)                                          | 0 16.00     | 0 14.00          | 0 20.00         | 0 14.00     | 64  |
|                                                              | 30          | 30               | 30              | 30          | 120 |

Critical value of .05  $\chi^2$  df 6 = 12.59       $\chi^2 = 8.05$  NS

Table 13 (Continued)

| Indicate                                 | Cells       |                  |                 |             |     |
|------------------------------------------|-------------|------------------|-----------------|-------------|-----|
|                                          | Navy<br>1.3 | Air Force<br>2.3 | Civilian<br>3.3 | Army<br>4.3 |     |
| Indicate 3 (Test item C): Subject Matter |             |                  |                 |             |     |
| unfavorable (d and e)                    | 0 2.00      | 0 3.00           | 0 1.00          | 0 5.00      | 11  |
| neutral (c)                              | 0 7.00      | 0 4.00           | 0 8.00          | 0 6.00      | 25  |
| favorable (a and b)                      | 0 21.00     | 0 23.00          | 0 21.00         | 0 19.00     | 84  |
|                                          | 30          | 30               | 30              | 30          | 120 |

Critical value of  $.05 \chi^2$  df 6 = 12.59 $\chi^2 = 5.00$  NS

Table 14

**Analysis of Variance to Test Perceptual Distortion of the  
Combined Opinion Questions: High Stratum**

| <b>Treatment Group</b> | <b>Number</b> | <b>Test</b> |             |                 |
|------------------------|---------------|-------------|-------------|-----------------|
|                        |               | <b>Mean</b> | <b>S.D.</b> | <b>Variance</b> |
| Navy                   | 30            | 9.87        | 2.30        | 5.29            |
| Air Force              | 30            | 10.10       | 2.26        | 5.13            |
| Civilian               | 30            | 9.37        | 1.92        | 3.69            |
| Army                   | 30            | 10.67       | 1.90        | 3.61            |

| <b>Source of Variation</b> | <b>Sum of Squares</b> | <b>Degrees of Freedom</b> | <b>Mean Square</b> | <b>F-Ratio</b> |
|----------------------------|-----------------------|---------------------------|--------------------|----------------|
| Between Groups             | 26.20                 | 3                         | 8.73               | 1.97 NS        |
| Within Groups              | 513.80                | 116                       | 4.43               |                |
| <b>Totals</b>              | <b>540.00</b>         | <b>119</b>                |                    |                |

The independent variable is the treatment group.

The dependent variable is the total score of the opinion questions.

Critical value of .05 F df 3,116 = 8.55

Table 15

**Analysis of Variance to Test Perceptual Distortion of the  
Combined Opinion Questions: Medium Stratum**

| <b>Treatment Group</b> | <b>Number</b> | <b>Test</b>  |             |                 |
|------------------------|---------------|--------------|-------------|-----------------|
|                        |               | <b>Mean</b>  | <b>S.D.</b> | <b>Variance</b> |
| <b>Navy</b>            | <b>30</b>     | <b>10.13</b> | <b>2.10</b> | <b>4.40</b>     |
| <b>Air Force</b>       | <b>30</b>     | <b>9.80</b>  | <b>1.54</b> | <b>2.37</b>     |
| <b>Civilian</b>        | <b>30</b>     | <b>10.20</b> | <b>1.75</b> | <b>3.06</b>     |
| <b>Army</b>            | <b>30</b>     | <b>10.33</b> | <b>1.71</b> | <b>2.92</b>     |

| <b>Source of Variation</b> | <b>Sum of Squares</b> | <b>Degrees of Freedom</b> | <b>Mean Square</b> | <b>F-Ratio</b> |
|----------------------------|-----------------------|---------------------------|--------------------|----------------|
| <b>Between Groups</b>      | <b>4.63</b>           | <b>3</b>                  | <b>1.54</b>        | <b>.48 NS</b>  |
| <b>Within Groups</b>       | <b>369.73</b>         | <b>116</b>                | <b>3.19</b>        |                |
| <b>Totals</b>              | <b>374.37</b>         | <b>119</b>                |                    |                |

The independent variable is the treatment group.

The dependent variable is the total score of the opinion questions.

Critical value of  $F$  .05 df 3,116 = 8.55

Table 16

**Analysis of Variance to Test Perceptual Distortion of the  
Combined Opinion Questions: Low Stratum**

| <b>Treatment Group</b> | <b>Number</b> | <b>Test</b> |             |                 |
|------------------------|---------------|-------------|-------------|-----------------|
|                        |               | <b>Mean</b> | <b>S.D.</b> | <b>Variance</b> |
| Navy                   | 30            | 10.80       | 1.45        | 2.10            |
| Air Force              | 30            | 10.23       | 1.94        | 3.77            |
| Civilian               | 30            | 10.47       | 2.00        | 3.98            |
| Army                   | 30            | 9.97        | 1.88        | 3.55            |

| <b>Source of Variation</b> | <b>Sum of Squares</b> | <b>Degrees of Freedom</b> | <b>Mean Square</b> | <b>F-Ratio</b> |
|----------------------------|-----------------------|---------------------------|--------------------|----------------|
| Between Groups             | 11.27                 | 3                         | 3.76               | 1.12 NS        |
| Within Groups              | 388.60                | 116                       | 3.35               |                |
| <b>Totals</b>              | <b>399.87</b>         | <b>119</b>                |                    |                |

The independent variable is the treatment group..

The dependent variable is the total score of the opinion questions.

Critical value of .05 F df 3,116 = 8.55

Table 17

**Analysis of Variance to Test Perceptual Distortion of the  
Combined Opinion Questions: Combined Strata**

| Treatment Group | Number | Test  |      |          |
|-----------------|--------|-------|------|----------|
|                 |        | Mean  | S.D. | Variance |
| Navy            | 90     | 10.27 | 2.00 | 4.00     |
| Air Force       | 90     | 10.04 | 1.93 | 3.71     |
| Civilian        | 90     | 10.01 | 1.93 | 3.72     |
| Army            | 90     | 10.32 | 1.84 | 3.37     |

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Square | F-Rat. |
|---------------------|----------------|--------------------|-------------|--------|
| Between Groups      | 6.59           | 3                  | 2.20        | .59 NS |
| Within Groups       | 1316.07        | 356                | 3.70        |        |
| Totals              | 1322.66        | 359                |             |        |

The independent variable is the treatment group.

The dependent variable is the total score of the opinion questions.

Critical value of .05 F df 3,356 = 8.54

groups by stratum and combined strata. These analyses are shown in Tables 14 through 17.

Test Development Group and Experimental Group Differences

Test development and related procedures were discussed in Chapter 3. It was noted that the subject selection procedures used for test development were slightly different than those used in the experiments that followed. The difference was that the test development subjects were post-selected. This means the subjects were selected out of a group of new students after the group of new students had been tested en masse. Although the same subject selection criteria was used, experimental subjects were all pre-selected before experimentation. Therefore, experimental groups consisted only of subjects who had already met the subject selection criteria.

Since the Air Force technical sergeant instructor treatment variable program was used for test development purposes, it was necessary to inspect the results of the experimental group that had been exposed to the same television program to see if the test means of these two groups remained approximately equal. Inspection revealed that the means of the two treatment groups were different. The differences are illustrated in Table 18.

It was decided to proceed without additional verification of the learning test because the results of this study (Tables 7 through 10) indicated that the differences between the test development treatment group mean and each of the experimental treatment group means were approximately equal. Since Tables 7 through 10 illustrate that there

Table 18

Comparison of Cognitive Test Score Means of Experimental Treatment Group and Test Development Treatment Group Exposed to the Air Force Technical Sergeant Treatment Variable

| <u>Air Force Technical Sergeant Treatment Variable</u> |                    |                        |    |
|--------------------------------------------------------|--------------------|------------------------|----|
|                                                        | Experimental Means | Test Development Means | n  |
| High Ability Level Cells                               | 30.20              | 28.33                  | 30 |
| Medium Ability Level Cells                             | 25.17              | 21.53                  | 30 |
| Low Ability Level Cells                                | 18.20              | 11.27                  | 30 |
| Treatment Group<br>(Combined Cells)                    | 24.52              | 22.29                  | 90 |

were no significant differences within the means of the experimental treatment groups there is reason to believe the learning test was reliable and hence the experimental results were not affected by the difference in means between the test development group and the experimental group that viewed the television program using the Air Force Technical Sergeant instructor variable.

Had the first part of this chapter revealed differences in learning within the treatment groups, the test would have required further verification because it would not be known whether the differences were attributable to the instructor uniforms or an unreliable test. However, since no differences appeared within experimental treatment groups for the test, there was reason to believe the test was reliable in that the same results occurred within the various experimental treatment groups.

The most apparent reasons to be conjectured for the difference in test scores for the Air Force technical sergeant uniform treatment variable for the test development group and the experimental groups are (1) the post-selection procedures resulted in a larger number of people being tested at one time, some of which were not subsequently used as test development subjects, and (2) the number of test questions was larger in that test development subjects answered fifty-eight items while experimental subjects answered forty-two.

Even if these factors did create the differences in treatment group test means, the differences were the same between the test development treatment group and each of the experimental treatment groups. As such, the difference probably did not affect the results of this study.

Inspection of Opinion Responses

Inspection of Chi Square Tables 11 through 13 illustrate that the subject matter question (Item C) received the most favorable response from the three ability level strata. Note that the medium stratum rated this question favorable fewer times than did the high or low stratum subjects. The favorable responses by strata to television as a medium of instruction (Item A) and the instructor as a teacher (Item B) were approximately equal. However differences between strata appear in an inspection of the unfavorable responses to these two items. Subjects of the high stratum rated Item A unfavorable 41 times as compared to 28 and 28 for the medium and low strata.

Perhaps the most significant results of this inspection are revealed by looking at the question about the instructor (Item B). This was the item most closely associated with the question of whether incongruent instructors would create differences in perceptual distortion. Subjects were much more prone toward neutral responses for the instructor (Item B) than on any other item. At the same time they were much less prone to rate the instructor unfavorably. Irrespective of strata or treatment group, the number of favorable, neutral and unfavorable responses to the instructor were 160, 149 and 51 respectively.

According to Osgood and Tannenbaum's study (page 21 of this paper) the large number of neutral responses could be called "no attitude at all." Therefore in terms of group dissonance arousal, the proportion of neutral responses in light of the paucity of unfavorable responses could lead to an inference that, on the average, the instructor uniform was probably not an ego-involved issue of a degree sufficient to arouse dissonance.

## Chapter 5

### CONCLUSIONS

#### Introduction

Although the statistical results of this study were negative and the conditions of an experimental investigation limit the parameters in which one can render valid generalizations, the implications of this study indicate that it contributed to both the practical and theoretical considerations used to justify the study.

In practical terms, this study provides evidence that incongruent instructors do not create differences in learning and perception within the television medium of instruction. Secondly, certain interpretations of the theory of cognitive dissonance raise questions about the wisdom of recommendations to discontinue comparative studies between the television medium and other media of instruction. Third, until disproved, similar applications of the conceptual model of this study remain as potential approaches to some important contemporary issues in education. With improvement and modification, the conceptual model of this investigation could be applied to a variety of investigations about the possible affect of teacher race and status on student learning and perception in various instructional media.

Restatement of the problem. The purpose of this study was to determine whether cognitive learning scores and perceptual distortion indicates of United States Air Force basic airmen would be affected by

utilizing educational television instructors from different branches of Department of Defense services.

Restatement of the proposition. Subjects viewing the Air Force Technical Sergeant instructor would learn more than their counterparts who viewed incongruent instructors not wearing the Air Force uniform. Further, subjects viewing the Air Force Technical Sergeant instructor would more favorably rate the perceptual distortion indicates than their counterparts who viewed incongruent instructors not wearing the Air Force uniform.

#### Experimental Conditions

In terms of conventional research design the conclusions of the study should be applied in terms of the experimental conditions under which the study was undertaken. These conditions were:

1. The television medium was the vehicle for instruction.
2. The treatment variables were Air Force Technical Sergeant uniform, Navy Petty Officer First Class uniform, Army Staff Sergeant uniform and a business suit typical of a United States Civil Service employee.
3. The matching criteria were: (a) First term male airmen who recently completed the first portion of basic training and were transferred to Lowry to attend a technical training school, (b) Ages seventeen through twenty-three at the time of selection, and (c) High school graduates or above.
4. Subjects were stratified on the basis of intelligence score ranges of ten through sixty-two, sixty-two through eighty-three, and

eighty-three through one hundred respectively for the low, medium and high strata. Further, only airmen with two or more of the four available aptitude percentile scores in the basic intelligence stratum range qualified as experimental subjects.

5. The subject material, "How To Study," was neutral in that it contained no inherent biases within treatment variables.

6. The subjects did not directly volunteer for experimentation.

#### Conclusions

The following conclusions were made on the basis of the statistical results of the study:

1. Given the experimental conditions of the study, incongruent instructors made no difference in learning achievement.

2. Given the experimental conditions of the study, incongruent instructors made no difference in perceptual distortion.

#### Implications of Conclusions

The divisions of Chapter 1, "Justification for the Study" were concerned with practical, instructional television, and theoretical results of this investigation. The two-part conceptual and experimental model was also introduced in the first chapter. The implications of the study will be treated in a similar manner.

Practical. In the justification of the study it was suggested that the results of this investigation could render data to support or dispute Department of Defense common use of instructional television regardless of which service produced a program. Since each branch of service has an audio-visual agency or agencies to produce instructional

television programs, common use by the Department of Defense would mean, for example, that the Navy could use an Army produced program in which the instructor would appear in an Army uniform. In the proposition, it was hypothesized that these incongruent instructors could create differences in learning and perception.

The results of this study indicate that the incongruent instructors created no differences in learning or perceptual distortion. The problem here is that in terms of sampling theory and research design the results of this one isolated study should not be generalized to the Air Force population as a whole or to other situations different than what would be implied under the conditions of the study.

For example, sampling theory would suggest that the results of this study should not be generalized to the Air Force population as a whole because the study did not include a random sample of that population. Subjects were drawn from a segment of the Air Force population that was located at Lowry. There was a reason why these subjects were assigned to Lowry rather than to some other technical training center. Those reasons, whatever they may be, would render the Lowry population of new students possibly different from students that were assigned to other locations. Theoretically, the Lowry new student population should not be considered representative of the new student population of the Air Force as a whole.

Conditions other than the population sample are also important. Theoretically, the results of the study should not be generalized beyond the design conditions of the study. For example, the reader is requested to recall the discussion about neutral subject material. A biased lesson topic that was on a subject peculiar to some other branch of

service might have increased the possibility of dissonance arousal in this study. Further, it was assumed that the topic, "How To Study," was neutral in so far as it appeared to be without inherent biases between the services. Because of the assumption, it is theoretically tenuous to generalize the results of the study beyond the condition that the subject material be on "How To Study." Similar examples could be created for each condition of the study. The point is that generalizations should be limited to situations that approximate the conditions of the study.

Conversely, these limited conditions do not mean that the investigation is without value. It is possible to render limited generalizations on the basis of statistical trends. If several similar studies indicated that incongruous television instructors made no differences in student learning and perception, a statistical trend would be established to lend support to broader generalizations that the results of this isolated study could not attest to.

Further, the conditions for practical application of this study are in practice strictured only by good judgment of a decision maker in the light of the evidence that is available. This means that in practical terms the decision maker in the field can (if he so desires) render broader generalizations than the conditions of the study would theoretically dictate.

If such were the case the experimental conditions of this study would likely be generalized to include the parameters of an Air Force population similar to the matching criteria of this study. The treatment variables would probably be generalized to include any combination of separate service military ranks that were equivalent. The subject

material of the television lessons would probably be generalized to include any subject material that was neutral in terms of the treatment variables. Since so little is known about the possible affect of a medium of instruction on the arousal of dissonance, it would seem apparent that any generalizations be limited to instruction that occurred in the television medium.

Instructional television. In the justification of this study it was suggested that although television was necessary because of the practical and control questions, the investigation was almost unique in that it was directed toward finding more efficient means for learning within the medium of television by itself.

It was difficult to express the concept of what the implications of this study might be to instructional television without suggesting additional comparative studies between media of instruction such as the live medium versus the television medium versus the film medium for some controlled variable. Although the literature on instructional television is inconclusive, it does suggest that the time for comparative studies is past. The comparative studies have indicated that television can be an efficient medium for instruction. But this conclusion is generally qualified by suggestions that the medium be used in a well-coordinated overall effort in combination with other aids including a live instructor. In other words it would seem that television should be used as any other training aid. The principle remains the same. Use television only when it can enhance an instructional situation. Therefore the question arises as to just what kind of comparative studies was being discussed and whether the elimination of all comparative studies would detract from the goal of making television instruction more efficient.

Implications drawn from the conclusions of this investigation do not suggest directly that comparative studies would be necessary in order to render television instruction more efficient. However, the need for a certain approach to comparative studies may be inferred by analyzing the theoretical basis for this study in reference to what may possibly occur in the television medium as compared to other media of instruction.

The theory of cognitive dissonance was applied to the concept that there may be a measurable relationship between learning and perception when a lesson was presented through television. Perhaps studies similar to this investigation in other media such as the live medium or film medium would find that the communications medium itself may effect or negate the conditions necessary for the arousal of dissonance. Television may have a tendency to wash out the personal contact associated with some ego-involved issues. Without ego-involvement there could be no dissonance.

The medium of black and white 21 inch television may be quite different from wide screen color film. Both are different from a live presentation in which the instructor appears in person. Most comparative studies appear to have been designed to prove which medium was the best instructional vehicle in a particular situation without delving into whether the medium itself could create differences in perception and hence learning. Perhaps some of these situations were inadvertently conditioned in such a manner as to arouse dissonance in one medium and not the other. If this were true it could help to explain why the results of comparative studies have tended to be inconsistent.

For these reasons, the conceptual model of this study could possibly be useful if the trend of media investigations shift toward finding

what creates differences in dissonance arousal for one medium that are not apparent in another. The comparisons of learning could wait until situations had been uncovered in which dissonance arousal was proved significantly different between two mediums of instruction. Some implications of this concept will be discussed in the following section.

Theoretical. In the justification of the study this investigation was defended in terms of an approach to investigating some questions about learning theory and perceptual discrimination. The review of literature suggested several critical theoretical issues. The issues were ego-involvement, the relationship of ego-involvement and time to the television medium, and volition. The theoretical implications as to why no differences were found in learning and perceptual distortion in this study follow.

The criterion for whether an idea (cognition) and in this case a group norm has been assimilated is the behavior of a person. Once a cognition is assimilated it must be maintained unless displaced by a reorganization of ideas. Ambivalent behavior means that contradictory ideas are competing for acceptance. And only the person can reorganize these ideas into a unified whole. Inconsistent ideas would only affect behavior to a significant degree when self-image was involved. In this study it was necessary to determine whether identification with the Air Force was ego-involved enough to create dissonance when non-Air Force instructors were utilized for teaching basic airmen. The perceptual distortion indicate group scores were designed to suggest whether dissonance was present. And if the presence of dissonance was suggested, the learning rates were predicted to be lower because some of the psychic

energy would be used in maintaining cognitive balance rather than for learning. If the design of this investigation provided controls for undesired variables, then a theoretical implication arising from the lack of differences found in this study would be that the assumed group norm (identification with the Air Force uniform) was not ego-involved enough to create dissonance when subjects were exposed to incongruent instructors.

The second theoretical issue was concerned with the length of exposure to the various instructor uniforms. Both Lecky and Festinger indicated that dissonance could be temporary. The assimilation of ideas into the organizational process was viewed as dynamic, constantly changing and being modified as an individual matured. Therefore, the appropriate length of time to expose the various instructor uniforms to subjects was not known. The time was eventually predicated on the amount of subject material believed necessary to develop a valid and reliable cognitive test instrument. But dissonance should occur instantly as soon as an unexpected instructor appeared. In a live medium it would be expected that dissonance would decrease relative to the length of exposure. As the students began to use mechanisms to reduce dissonance they would begin to rationalize away the effect of the unexpected instructor uniforms and in the end probably judge the instructor relative to his competence and common human characteristics.

The third consideration revolves around the medium of communication. The effect may be different in the television medium versus another medium of instruction. The subjects may have already learned to react to the television medium differently than a live medium. Since television is essentially a one-way medium the human and personal element

may have been learned to be viewed as inconsequential. This may be reasonable in light of the fact that very few television viewers have ever been able to initiate a personal relationship with a television personality. And certainly they were unable to do so in reverse fashion, or in a manner of speaking, "through the tube." This possible difference created by how a person uses the medium may be illustrated by imagining the difference in ego-involvement between the active participants in a live riot versus the ego-involvement of those who view the same riot on television. Even if television coverage was biased by making a small mob appear out of proportion to the live event by concentrating on close shots of threats and violence; the amount of adrenalin released by live and television participants would be different. As such it would be expected that if all other conditions were equal, there would be a difference in the amount of ego-involvement between live medium and television medium participants.

If there is anything to these arguments it could be expected that the subjects had already learned that television was an impersonal medium in which real contact with the communicator was impossible. It would also seem reasonable to expect that possibly dissonant stimuli emitted from the twenty-one inch tube would be viewed more impersonally. As a result it would be more difficult to raise an ego-involved issue through television as opposed to a live medium situation. A television personality would probably be judged more on what was said rather than on the way he was dressed, the color of his skin or country of origin. In a very personal live medium, ego-involved issues would be more likely to become issues and hence possibly create differences in perception and learning.

Another theoretical consideration is the possible effect of volition. The review of the literature indicated that the arousal of dissonance was affected by volition, or whether a person freely chose to place himself into a possibly dissonant situation. Resistance and assimilation were natural processes and the individual learns that in order to continue to develop he must face dissonant situations. If a person has no choice in the matter the degree of ego-involvement and hence dissonance arousal would not be as great.

In this study the subjects did not directly volunteer for experimentation. However they did volunteer into the Air Force with the realization that training was a product of that action. The practical justification of this study rendered the use of experimental volunteers unrealistic. Therefore nothing was built into the design to separate the differences created by volition versus ego-involvement. Volition was merely another factor possibly contributing to ego-involvement. And since the perceptual distortion indicate group scores were not different within treatment variables, it was to be expected that dissonance was not present. And if the design controlled for unwanted variables, the reason for the lack of dissonance was probably that the group norm or identification with the Air Force Technical Sergeant uniform (or for that matter any of the uniforms) was not an ego-involved issue of sufficient strength to create dissonance over an incongruent instructor. The factor of volition may have contributed to this lack of ego-involvement.

Conceptual model. On page 5 of this study an attempt was made to justify the use of "models" to predict learning outcomes in educational research. Stolurow (1965) believed the models would force an investigator

to enumerate and control for the variables responsible for a prediction. Evidently, the models could be tested and corrected through a series of research projects until they became viable instruments for the application of learning theory. Otherwise the tests and modifications would suggest that the models were poor predictors and the concept would eventually be discredited.

Later, on pages 7 through 13, an introduction of the two-part model of this investigation discussed the differences between an approach to the conceptual model and the design of the experimental model. The following discussion centers on the conceptual model, because the design of the experimental model resulted from the conceptual model and some practical restraints of the study. And a variety of experimental models could be designed to test the conceptual model.

The conceptual model attempted to directly apply the theory of cognitive dissonance to the experimental model to predict perceptual distortion and decreased learning. Although the approach and theory were discussed elsewhere, the most precise statement of the conceptual model may be found in the proposition and the one paragraph explanation that follows it. Although there is nothing new in the conceptual model, the way in which the elements were combined represents an application of the theory of cognitive dissonance to explain and predict the possible interaction of cognitive and affective elements of learning in small groups.

As a result of this study the concept that cognitive and affective elements of the personality could possibly be associated through the correct application of the theory of cognitive dissonance remains in limbo. This study did not disprove it. Since there were no differences

in the affective element, according to the conceptual model it would be expected there was no differences in the cognitive element. Had there been differences in one and not the other, support would be present to discredit the conceptual model.

Since this particular application has neither been proved nor disproved, the model has the potential of being modified and tried under conditions where perceptual distortion is present to see if there will be corresponding differences in learning. This model has raised some intriguing questions. Hopefully, similar applications in the future will either prove or disprove the conceptual model.

Recommendations for Further Study

1. Similar studies should be completed within the service branches of the Department of Defense using a variety of lesson topics, different age groups and different subject populations. The results of several investigations would possibly establish a statistical trend from which broader practical generalizations could be rendered.
2. Similar studies should be completed in several media of instruction to determine whether perceptual distortion under certain conditions is associated with a medium of instruction not apparent under the same conditions in another medium.
3. The conceptual model of this study could be used as the basis of experimental designs in a variety of contemporary issues in which a pilot study should determine, whenever possible, significant differences in perceptual distortion before experimentation began.

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**APPENDICES**

**APPENDIX A**

**TELEVISION PROGRAM**

For the purpose of clarity Appendix A is divided into six subsections. Appendix A-1, lesson goals, was constructed after reviewing the subject matter literature and before the lesson script was written. The lesson goals were considered general enough to allow for a flexible script while being narrow enough to provide an adequate guide in the development of the televised lesson. The desired learning objectives are more specific and were constructed after the script was reviewed and considered adequate. The desired learning objectives were matched with the lesson goals and used as a guide for test item construction. The desired learning objectives were considered as being appropriate to the test instrument and were therefore placed in Appendix C, test instrument. Appendix A-2 is a description of the symbols necessary to interpret the script. The television lesson script has been placed behind the symbols and labeled Appendix A-3. Appendix A-4 is included to illustrate the graphics. The graphics were created on 11 x 14 inch grey cards with black tempra for lettering and diagrams. The scaled facsimiles in Appendix A-4 were labeled G 1 through G 30. The context of the televised program can be maintained by cross referencing between Appendices A-3 and A-4. A set diagram and list of equipment were included to satisfy requirements for replication. These were included in Appendices A-5 and A-6. Finally, Appendix A-7 contains expert testimony that there were no significant differences between the television lessons except the uniform variables.

## APPENDIX A-1

### LESSON GOALS

1.0 The first goal of this lesson is that each student should demonstrate knowledge of the curve of forgetting.

2.0 The second goal of this lesson is that each student should demonstrate knowledge of distributive reinforcement.

3.0 The third goal of this lesson is that each student should demonstrate knowledge of the principles of learning.

4.0 The fourth goal of this lesson is that each student should demonstrate knowledge of the 3 - R system of learning through reading.

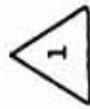
5.0 The fifth goal of this lesson is that each student should demonstrate knowledge of some relationships of the curve of forgetting, distributive reinforcement, principles of learning and the 3 - R system of learning through reading.

6.0 The sixth goal of this lesson is that each student should demonstrate comprehension of some relationships of the curve of forgetting, distributive reinforcement, principles of learning and the 3 - R system of learning through reading.

7.0 The seventh goal of this lesson is that each student should demonstrate application of the concept of distributive reinforcement, the principles of learning, and the 3 - R system of learning through reading.

## APPENDIX A-2

## SYMBOLS



Floor camera designated 1 or 2. This symbol always used with talent.

- C close shot.
- M medium shot.
- L long shot.
- MC medium close shot.
- ML medium long shot.



Full screen graphic from floor camera with graphic and camera as indicated.



Edited segment from master video tape.



Key with graphic and floor camera as indicated. This symbol always indented.



Narrative passage underlined to illustrate beginning and end of key above.

Edit point for a VT segment or to set up graphics.



## APPENDIX A-3

## VISUAL

VT 1

## SCRIPT

## AUDIO

"beep beep . . . beep beep."

(Sound effects record SEL-12-B, Track 15, Armed Forces Radio and Television Services, 1016 North McCadden Pl., Los Angeles 38, California, 1964.)



1 After VT 1 begin LS at defocus. Focus and zoom in to MS.

Begin in limbo light  
(back lights only),  
slowly bring in full.  
Full just before the  
talent begins.

Lights remain full  
to end.

Cue instructor. \_\_\_\_\_

An airman basic of 25 had been abandoned on a desert island since the age of 17. One day while in search of food he stumbled across a beautifully sensuous female lying on the

VISUAL

AUDIO

beach nearly naked . . . she had been washed ashore from a shipwreck just that morning. After they got over the initial shock at seeing each other, the girl wanted to know how long he had been alone on this barren bit of land.

"Almost eight years," he said.

"Eight Years!" she exclaimed! "But how did you survive?"

"Oh, I fish, dig for clams, and gather berries and coco-nuts," he replied.

"And what do you do for sex" she asked.

"What's that?" . . . he looked puzzled.

"Whereupon the bold maiden pulled the innocent airman down onto the sand beside her.

After awhile she asked if he had enjoyed it.

"Great!" was the reply. "But look what it did to my clam digger!"

MC

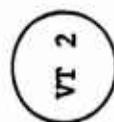
Yes, we are all born with certain tools . . . we all have abilities, intelligence and skills which while used . . . are not always used in the best fashion or proper manner. We somehow learn to do tasks a certain way . . . it becomes habit . . . and like the young airman, we roll along through life, boxed in by habit and never really looking for another use or possibly better way of using our talent.



## VISUAL

## AUDIO

This program is about talents . . . talents that most people misuse because they've locked them up in a box of bad habits since childhood.



Bugle call ending with "CHARGE."

(Sound effects record SEL-13-B, Track 3, first 3 seconds, Armed Forces Radio and Television Services, 1016 North McCadden Pl., Los Angeles 38, California, 1964. "Charge" added from four live voices in sound booth. Total is five seconds.)



Background music at G 1 and continuing through G 3.



(Begin after 10 second introduction on Production Music Library No. 3, Side 2, Cut 4. Record produced by Capital Records, Customs Division, 1016 North McCadden Pl., Los Angeles 38, California, no date.)



Cut motor for run down record sound just after G 3 appears.



Now that is a let down . . . you thought it was going to be about the various uses of the clam digger.

## VISUAL

## AUDIO

But the story serves a very important point. If you are an average group, there is not one of a hundred of you that really know how to use your talent for study.

Why? . . . because a long time ago you either didn't develop good study habits or didn't develop any study habits at all. And if you are like most people you probably drifted along through your schooling without ever really worrying about efficiency in learning. You could get by without it. As a result you probably wasted a lot of what time you did put in study . . . and relative to that time you didn't learn much either. For that reason . . . the real title of this program should be "How to learn more without really trying" . . . or in other words, "How to learn more without spending anymore time at it."

To do this, let us start by looking at forgetting. You've been forgetting more than you've learned for most of your life.

1  
G 4

(5 sec. pause to view graphic, then cue talent to talk over graphic)

You can call this a curve of retention or the rate of forgetting, whichever way you want to look at it. A temporary of your great grandfather named Ebbinghaus developed this curve from the results of experiments with students. And since 1885 many similar studies have verified it.

VISUAL



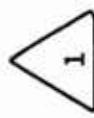
AUDIO

(5 sec. pause to view graphic, then cue talent to talk over graphic.)

After only one hour people forget more than they have learned.

(Pause)

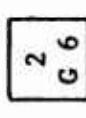
And after one month you remember practically nothing.



MC

(Talent on camera again)

Of course you know this. Or at least you feel it intuitively. So what do you do? You CRAM . . . or at least most people do.



(5 sec. pause to view graphic, then cue talent to talk over graphic.)

If the test is the first thing in the morning, and there wasn't very much to learn, you can do pretty well on the test and then forget it. But, with only a 20 minute break before the test, you have already forgotten 42 % of the material you learned in that one hour cram session.

## VISUAL

1  
G 7

---

(5 sec. pause to view graphic, then cue talent to talk over graphic.)

When there is a lot to learn and the test was given later in the day . . . you are in real trouble. You will have forgotten about 60 % of what you've learned.

2  
C

---

(Talent on camera.)

Ebbinghaus and others found out that there was an easier way to do it. A way that would give far better results without spending any extra time. How about breaking out of that box of tired habits?

1  
G 8

---

(Slight pause, then cue talent to talk over graphic.)

It's called distributive reinforcement. Researchers found that if a student uses a little gray matter to think about it . . . he divides the same amount of learning time into several study periods. Instead of cramming at the last minute, he begins studying the same day the material is first introduced while he can still remember most of it.

With each review the downward slope of the curve flattens out a little bit . . . After each review, the rate of forgetting is not so severe.

## AUDIO

1

---

(5 sec. pause to view graphic, then cue talent to talk over graphic.)

When there is a lot to learn and the test was given later in the day . . . you are in real trouble. You will have forgotten about 60 % of what you've learned.

2

---

(Talent on camera.)

Ebbinghaus and others found out that there was an easier way to do it. A way that would give far better results without spending any extra time. How about breaking out of that box of tired habits?

1

---

(Slight pause, then cue talent to talk over graphic.)

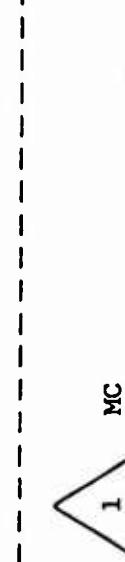
It's called distributive reinforcement. Researchers found that if a student uses a little gray matter to think about it . . . he divides the same amount of learning time into several study periods. Instead of cramming at the last minute, he begins studying the same day the material is first introduced while he can still remember most of it.

With each review the downward slope of the curve flattens out a little bit . . . After each review, the rate of forgetting is not so severe.

## VISUAL

This means that the next review can be of shorter duration. In other words, it doesn't take as much time to find out what you've forgotten . . . and the night before the exam, 5 minutes in review is sufficient rather than a one hour cram session beginning from scratch.

And upon arriving fresh for the test . . . the overall retention rate is much higher than could be expected from a cram session.



## AUDIO

This means that the next review can be of shorter duration. In other words, it doesn't take as much time to find out what you've forgotten . . . and the night before the exam, 5 minutes in review is sufficient rather than a one hour cram session beginning from scratch.

And upon arriving fresh for the test . . . the overall retention rate is much higher than could be expected from a cram session.

(Edit for set up.)-----

Distributive reinforcement produces striking results in these simple learning experiments. Of course the problem is that students "re" usually attempting to learn many subjects throughout various periods of the day. Thus the simple concept of distributive reinforcement becomes a complex problem when trying to apply it in every day situations. But distributive reinforcement can be applied to your individual advantage. The problem is that you have to want to learn badly enough to take the time necessary to organize your various courses and study habits on the basis of this concept.

Usually this means a review of any new material the same day it was introduced . . . and then scheduled review periods until the exam.

(Transition statement.)

Distributive reinforcement isn't the only thing necessary for efficient learning. The judicious application of the principles of learning will help.

VISUAL

AUDIO

(Pause for graphics announcing the Principles of Learning.)



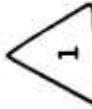
(Timed by reading graphic aloud.)

—(Edit for set up.)—  
—  
—



(Timed by reading graphic aloud.)

—(Edit for set up.)—  
—  
—



Distributive reinforcement may be the greatest thing since a new use was found for the clam digger . . . but it is important to remember . . . before our young shipwrecked airman could discover . . . he had to want to discover.

Without this willingness or desire or curiosity . . . name it what you will, he would never have agreed to any new experiences from his lovely teacher.



But he was ready for a new experience . . . and thus learned from it. This is called the principle of readiness. A student must be willing or motivated to learn.]

## VISUAL

## AUDIO

Sound simple? Well of course it does! But think back and remember yourself or others you have known . . . and how learning experience is not relevant . . . how is this going to help me?

But when you really get to thinking about it you can never tell just what situation you may eventually be faced with. Who would have ever imagined that the airman would eventually be stranded on his desert island.

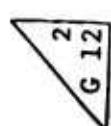
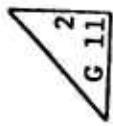
Yet . . . had he been trained during his high school years in survival techniques, he would have probably considered the training irrelevant.

This attitude could have affected his readiness for learning.

And a lack of readiness for learning can become a fatal habit. Have you locked yourself into that box?

The principle of exercise merely means repetition. Those things most often repeated are best remembered. [Distributive reinforcement proves this. The problem is that most students either don't apply this principle because of a lack of readiness . . . or if they try, they apply it improperly.

For example, they apply it improperly by trying to repeat everything 100 times in a cram session the night before the exam. It would be much easier to maintain a higher and flatter retention curve by repeating the material during several short review sessions.



## VISUAL



Effect is the next principle. [The principle of effect merely states that learning is strengthened when accompanied by a pleasant or satisfying feeling and weakened when associated with an unpleasant feeling.]

With this in mind we have produced the following graphic to aid your learning processes.

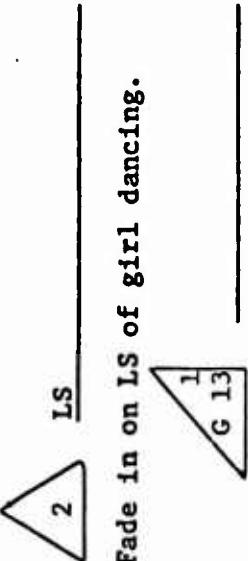


Black.

Bugle Call.

(Sound effects record SEL-13-B, Track 3, first 3 seconds, Armed Forces Radio and Television Services, 1016 North McCadden Pl., Los Angeles 38, California, 1964.)

Fade in background music for dance.



Fade in on LS of girl dancing.



When dance established, slowly fade in a LS key of G 13 and zoom in until graphic covers the screen.

## AUDIO



Effect is the next principle. [The principle of effect merely states that learning is strengthened when accompanied by a pleasant or satisfying feeling and weakened when associated with an unpleasant feeling.]

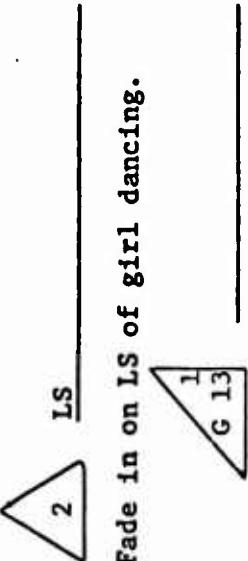
With this in mind we have produced the following graphic to aid your learning processes.



Bugle Call.

(Sound effects record SEL-13-B, Track 3, first 3 seconds, Armed Forces Radio and Television Services, 1016 North McCadden Pl., Los Angeles 38, California, 1964.)

Fade in background music for dance.



("Wild Weekend," by The Sufaris, DOT Records Inc., Hollywood 28, California, 1963.)



## VISUAL

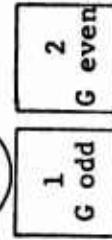
**Fade to black.**

## AUDIO

**Fade out music.**

M (Fade in.)

Since we probably lost you right there, this is as good a time as any to apply some distributive reinforcement before you take the test. So if you aren't ready to apply the principle of readiness please sleep through the next few seconds.



Background music.

(Begin after 10 second introduction on Production Music Library No. 3, Side 2, Cut 4. Record produced by Capital Records, Customs Division, 1016 North McCadden Pl., Los Angeles 38, California, no date.)

The first part of VT 4 is a review consisting of G 1 through G 12 alternating between camera #1 and #2. The odd numbered graphics were on camera #1. The even numbered graphics were on camera #2.

**Fade to black after G 12.****Fade out music after G 12.**

----- (Edit for set up on second part of VT 4) -----

VISUAL

Black



2

Fade in on ML view of dancing girl facing away from camera. She turns head toward camera.

13

When head turns, quickly fade in LS key of G 13 and fast zoom in until graphic covers screen.

Cut to black

- End of Vol 4 -

11

卷之三



2

(Sound effects record SEL-13-B, Track 3, first 3 seconds,  
Armed Forces Radio and Television Services, 1016 North  
McCadden Pl., Los Angeles 38, California, 1964.)

No. 200

2  
G 14

17

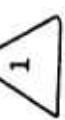
The fourth principle of learning is called primacy. It means that when something is a first experience it creates a strong impression.

Once something is learned, it is difficult to un-learn. This gets back to habits. If you use poor study habits, you're in a worse position than the person who has never learned anything at all.

VISUAL



AUDIO



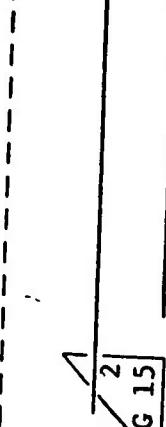
Frame M on still picture of bathing beauty. Begin from defocus, focus and make slow pan down and then up. Keep special effects generator in time with the beat of the music.

Frequency oscillator over background music to provide eerie effect.

(Wild Weekend by The Sufaris, DOT Records, Inc., Hollywood 28, California, 1963.)

Defocus a: top of pan and then fade to black.

Fade sound.



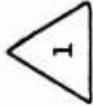
That probably didn't teach you anything, but it was meant to illustrate the principle of intensity. A vivid, dramatic, or exciting learning experience is more easily learned than a boring one. But whether or not you are ready to learn can do a lot to make an apparently boring class alive with excitement.



(5 sec. pause to view graphic, then cue talent to talk over graphic.)

The sixth and final principal is perhaps best illustrated by the curve of retention. Other things being equal, the things most recently studied are best remembered.

## VISUAL

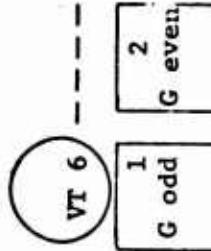


## AUDIO



Reviews before final exams and summaries at the end of lessons are good examples of how this principle is applied.

And with this in mind we will provide you with a visual summary of the lesson so far. This is an example of the direct application of the principle of exercise and the principle of recency.



The first part of VT 6 is a review consisting of G 4 through G 12 alternating between camera #1 and #2.

Fade to black after G 12.

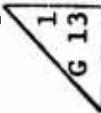
Fade out music after G 12

-(Edit for set up on second part of VT 6)- - - - -



No sound.

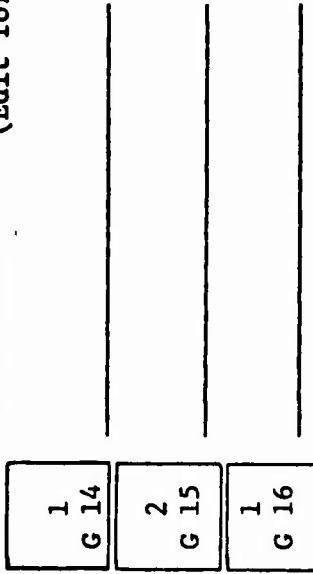
Fade in MC view of dancing girl smiling into camera.



When shot is established key G 13 in to fill screen.

VISUAL

Cut to black after a count of two.



Fade in background music.

(Begin after 10 second introduction on Production Music Library No. 3, Side 2, Cut 4. Record Produced by Capital Records, Customs Division, 1016 North McCadden Pl., Los Angeles 38, California, no date.)

Timed by reading each graphic before cutting to the next.

Cut to black after G 16.

Fade out music after G 16.

----- (End VT 6) -----



ML-slow zoom to-MC

I have attempted to make you aware that if you are like most people, you do a very poor job of utilizing your talent for learning. There is an easier and more efficient way of approaching a school situation. The most important point is that you have to first admit this to yourself and then be motivated to do something about it.

If you become motivated . . . you can begin to apply the principles of learning and distributive reinforcement to your specific learning situation. In other words . . . knowing vaguely about these principles is one thing, but applying them is something else again. The best students invariably

AUDIO

----- (Edit for set up on third part of VT 6) -----

Fade in background music.

(Begin after 10 second introduction on Production Music Library No. 3, Side 2, Cut 4. Record Produced by Capital Records, Customs Division, 1016 North McCadden Pl., Los Angeles 38, California, no date.)

VISUAL

AUDIO

organize a program of study that demonstrates the principles in each individual learning activity. For example, the principles can be applied to reading, listening, note-taking, manual activities and any number of learning tasks.

2  
G 17

(Transitional pause.)

To illustrate the principles in action we will look at the Three R system for learning through reading.

1  
G 18

(Transitional pause.)

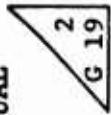
The first step is reconnaissance. (Pause.) The second read. (Pause.) And the third recall.

----- (Edit for set up) -----

1      2  
MC

Reconnaissance merely means a preliminary survey of the material to be read in order to determine the general plan. It does not mean that you read for details. This step can be accomplished in a number of ways depending on how the author organized his material. Chapter topics and sub-topics can be reviewed . . . or most authors give the key sentence to a paragraph either at the beginning or end of the paragraph. Some authors make a practice of including summaries at specific intervals or at the end of chapters. If none of these aids are available, the reconnaissance step can be accomplished by the best method of all . . . scanning.

## VISUAL



The reconnaissance step should provide you with the general picture and the main ideas. [ ]

The principles applied in this step would be readiness and primacy. If you are curious in the first place, this reconnaissance step should leave you with a few unanswered questions. This will help you work up a will to learn.

The reconnaissance step helps you to see the overall picture first. This should keep you from getting hung up on insignificant details. This would perhaps best illustrate application of the principle -- primacy.

VT 7

1  
G 18

2  
G 20

1  
G 21

— (Edit for VT) —  
— (No sound.)

## AUDIO

The reconnaissance step should provide you with the general picture and the main ideas. [ ]

The principles applied in this step would be readiness and primacy. If you are curious in the first place, this reconnaissance step should leave you with a few unanswered questions. This will help you work up a will to learn.

The reconnaissance step helps you to see the overall picture first. This should keep you from getting hung up on insignificant details. This would perhaps best illustrate application of the principle -- primacy.

— (Edit for VT) —

Timed by reading each graphic.  
Cut to black.

## VISUAL



The next step of the 3 R system is read - - active reading with an open mind. If the mind is relaxed and the feet propped up on a chair with cold beer at hand, it is doubtful if the reading step will be of much use. Your mind must be active and willing to grapple with each new point. Without this active interest and willingness the student is wasting his time. Perhaps more than anything else, this step represents the principle of readiness in action. Unless you are really motivated, effort spent on so-called study is a waste of time.

## AUDIO

VT 8

(Edit for VT)

2  
G 18

1  
G 19

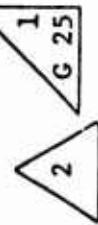
2  
G 20

(No sound.)

Timed by reading each graphic.

Cut to black.

## VISUAL

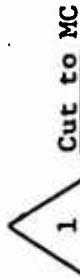
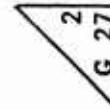
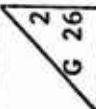
Cut to MC

## AUDIO

The final step of the 3 R system is recall. This is merely rephrasing in your own words what you have just read.  
It can be applied any time during the reading . . . at the end of a paragraph, topic or chapter. You can jot the ideas down on paper from memory. But this takes more time. It helps to repeat the ideas aloud. []

(Cut camera #1)

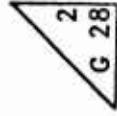
Recall is work because it requires thinking. And this is exactly why it works. Studies have demonstrated conclusively that students who actively practice the recall step make better scores on tests. The experiments have demonstrated that 50 percent of the time spent on the 3 R system should be devoted to the recall step. Many experts recommend more . . . even up to 70 percent.

1 Cut to MC

Depending on how an individual handles the recall step, it is possible to apply all of the principles of learning. For example, the principle of intensity may be applied from the way you put the author's meaning into your own words. Perhaps you will apply a vivid and direct experience [] of your own to his meaning. (Slight pause.)

[Since we tend to remember only the good things, the bringing up of this old experience would help to apply the principle of effect.] Learning is then a pleasant and satisfying experience.

## VISUAL



VT 9

|            |             |
|------------|-------------|
| 1<br>G odd | 2<br>G even |
|------------|-------------|

(No sound.)

A visual review consisting of G 17 through G 28 alternating between camera #1 and #2. Timed by quickly reading each graphic, then cut to black.

|           |           |           |           |
|-----------|-----------|-----------|-----------|
| 1<br>G 29 | 2<br>G 26 | 1<br>G 27 | 2<br>G 28 |
|-----------|-----------|-----------|-----------|

(No sound.)

## AUDIO

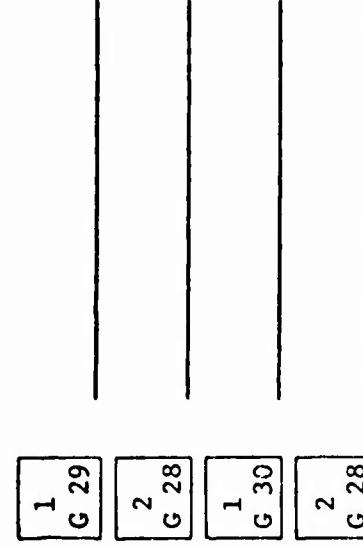
And of course, more than anything else the recall step applies the principle of exercise. This step provides one the opportunity to repeat and practice in many different ways the points that the author is trying to express. [ ]

—(Edit for VT)— -----

(No sound.)

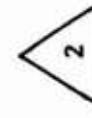
—(Edit for set up)— -----

VISUAL



Cut from camera to camera  
as fast as graphics can be  
switched.

Cut to black.



This concludes the lesson. Now we will summarize the points that were covered. This will be a living example of the application of the principles of recency and exercise. After the summary your monitor will pass out the written exam. The test begins with three opinion questions which will in no way be compromised. This portion of your exam will be scored separately without reference to your name. These opinion questions are merely designed to provide the audio-visual services with the feedback necessary to determine how you, our audience, accepts or rejects this block of instruction. So for the sake of other people who may have to view this program, please be candid.

## VISUAL

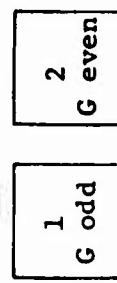
Cut to MC

I enjoyed doing this lesson and hope it helps you. And like our young airman on the desert island, please remember that if you actually apply what you've learned here today . . . who knows!, you too may find a better and more efficient use for one of your talents.

(Cut to black.)



VT 10



The first part of VT 10 is a review consisting of G 1 through G 28 alternating between camera #1 and #2.

Fade to black after G 28.

----- (Edit for visual insert only.) -----

Insert second part of  
VT 9.

Cut to black.

(Music insert should end with the final graphic, G 28)

Cut sound.

----- (End of VT 10) -----

END OF PROGRAM

## AUDIO

Cut to MC

I enjoyed doing this lesson and hope it helps you. And like our young airman on the desert island, please remember that if you actually apply what you've learned here today . . . who knows!, you too may find a better and more efficient use for one of your talents.

(Cut to black.)

(Edit for VT) -----  
(Insert music after the visual of VT 10 is complete.)

Background music.

(Begin at introduction on Production Music Library No. 3, Side 2, Cut 4. Record produced by Capital Records, Customs Division, 1016 North McCaden Pl., Los Angeles 38, California, no date.)

**APPENDIX A-4**

**GRAPHICS**

G 1

**HOW TO STUDY**

**Forgetting**  
**Distributive Reinforcement**  
**Principles of Learning**  
**3 R System for Reading**

G 3

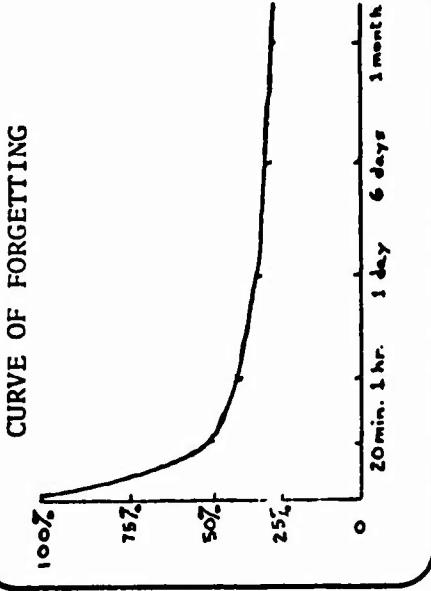
**YOU WILL BE TESTED ON THIS MATERIAL  
 IMMEDIATELY FOLLOWING THE LESSON**

G 2

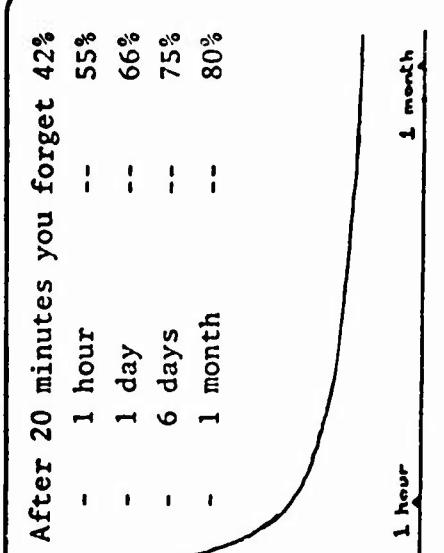
**HOW TO STUDY**

**Forgetting**  
**Distributive Reinforcement**  
**Principles of Learning**  
**3 R System for Reading**

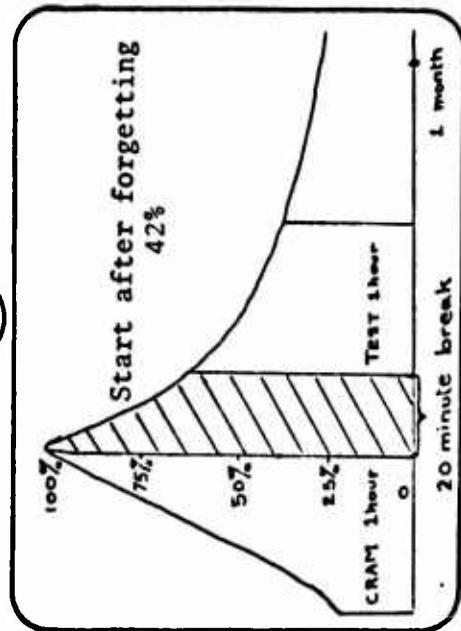
G 4



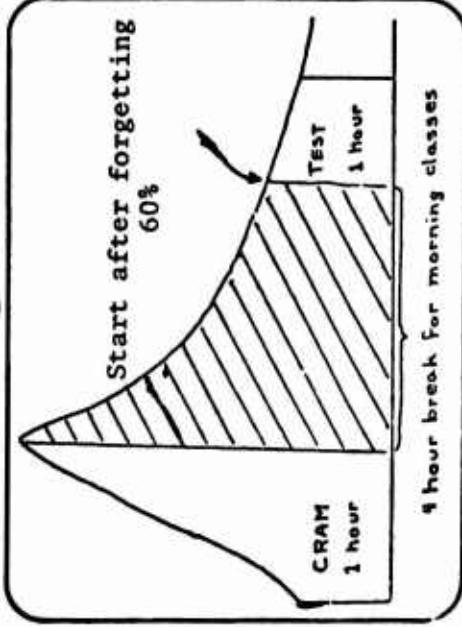
G 5



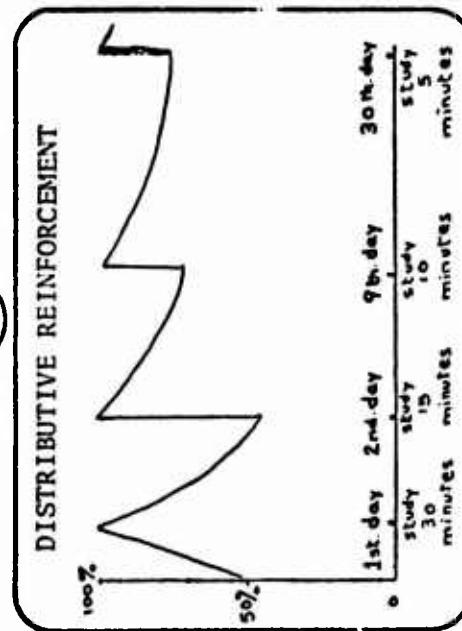
G 6



G 7



G 8



G 9

### The 6 Principles of Learning

- 1 readiness
- 2 exercise
- 3 effect
- 4 primacy
- 5 intensity
- 6 recency

G 10

- 1 readiness
- 2 exercise
- 3 effect
- 4 primacy
- 5 intensity
- 6 recency

G 11

- 1 READINESS

- 2 EXERCISE

G 12

- 2 EXERCISE

G 13

## 3 EFFECT

G 14

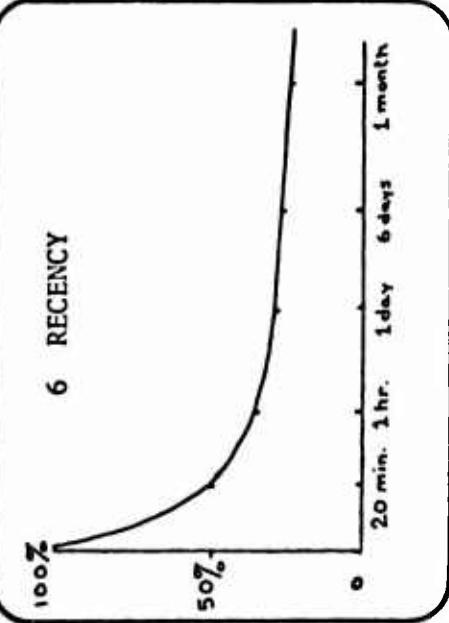
## 4 PRIMACY

G 15

## 5 INTENSITY

G 16

## 6 RECENCY



G 17

Reading to Learn

3 R

reconnaissance - read - recall

G 18

3 R

reconnaissance - read - recall

G 19

reconnaissance

applied

which principles?

G 20

reconnaissance

G 21

READINESS

and

PRIMACY

G 23

what principle can be applied

by

reading?

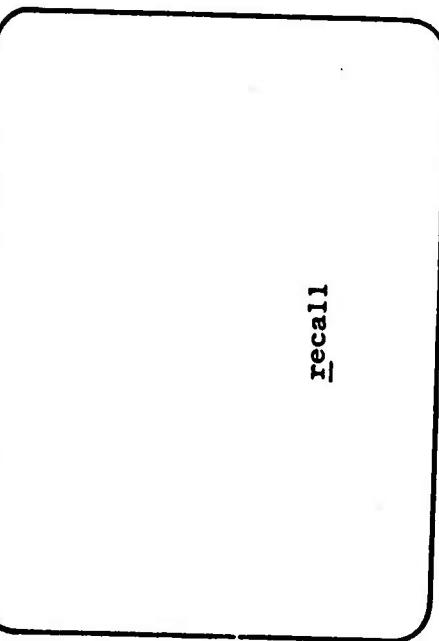
G 22

read

G 24

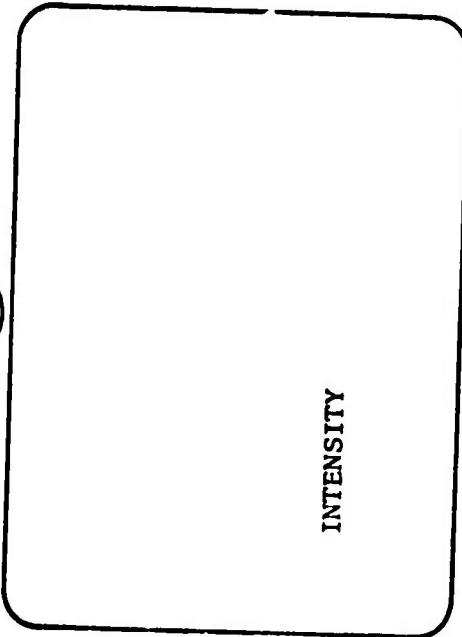
READINESS

G 25

recall

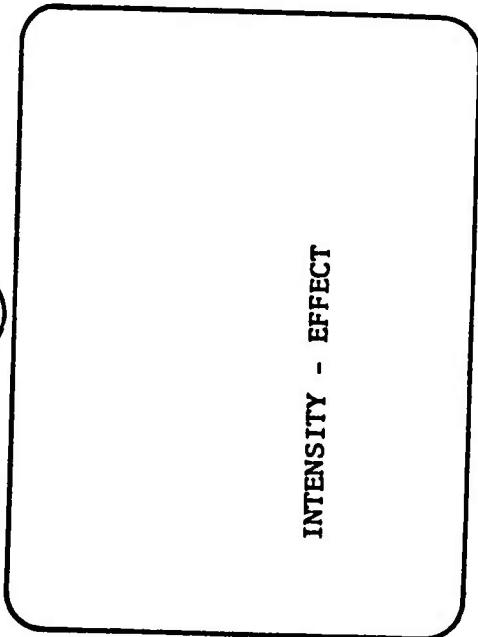
G 26

INTENSITY



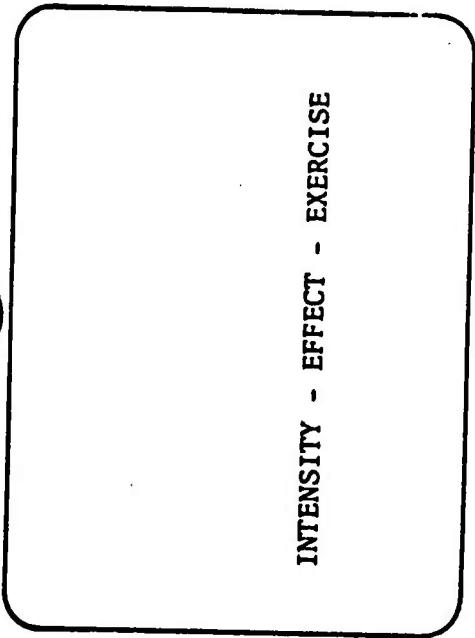
G 27

INTENSITY - EFFECT



G 28

INTENSITY - EFFECT - EXERCISE



G 29

what principles can be applied

by

,  
recall?

G 30

"W H A T"

does

recall

apply

\*Graphics were created on 11 x 14 inch grey cards using black tempura for lettering and diagrams.

## APPENDIX A-5

### SET DIAGRAM

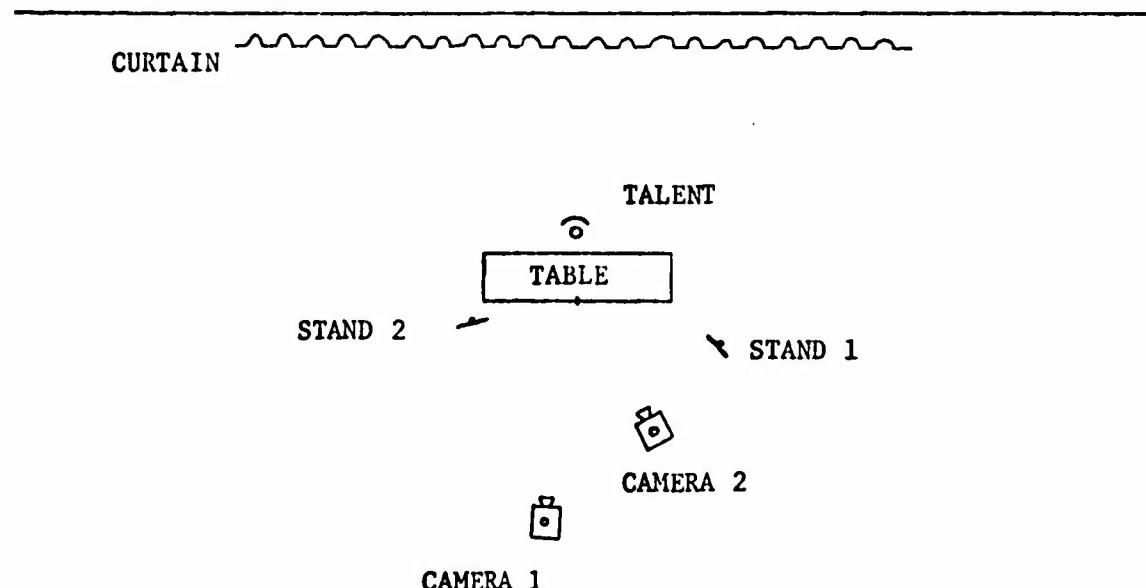


Figure 1

### Set

Position: Placement of talent's chair, table, cameras and stands were marked with tape placed on the studio floor.

Curtain: Light gray color.

Table: 20" X 8' 3", black cloth cover, rear edge 9' from curtain and 10' from wall.

Center of camera 1: 11' from center front of table, 11' from center of card stand 2. Center of card stand 2 to center front of table was 4' 8".

Center of camera 2: 8' from center front of table and 6' from center of card stand 1. Center of card stand 1 to center of table was 8' 4".

Set lighting: 125 foot candles on talent.

## APPENDIX A-6

### EQUIPMENT

**Cameras:** Standard monochrome image orthicon studio cameras made by Sarkes Tarzin Co., Bloomington, Indiana.

Camera 1 lens: 40 - 400 mm variable focal zoom lens.

**Camera 2 lenses:** Standard studio lens compliment consisting of 2, 3, 5 and 8 inch lenses on a rotating turret.

**Telepromptors:** Each camera was fitted with a telepromptor controlled by the talent via a hidden cable. The telepromptors were made by Telepro Industries Inc., Cherry Hills, New Jersey.

APPENDIX A-7

STATEMENT ON PROGRAM DIFFERENCES

Statement 1

Date: July 30, 1970

I have read the dissertation proposal and viewed the televiscd lessons on how to study produced by Ronald R. Calkins for his dissertation experiments. In my opinion there were no significant differences between the programs except for the uniform of the instructor.



---

Jay M. Sedlik, Captain, USAF  
Associate Professor of Psychology  
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**APPENDIX B**

**PERCEPTUAL DISTORTION INDICATES**

**DIRECTIONS:**

Items lettered A, B and C are opinion questions designed to provide the audio-visual services with the feedback necessary to produce a better product in the future. Please answer according to the way you honestly feel about the question. This portion of the test will be scored separately and without reference to your name or organization. Therefore, please mark the answers in the spaces provided for numbers 43, 44 and 45 on your answer sheet.

**A. (Item number 43 on your answer sheet)**

Teaching through television is one of the best methods of instruction!

- a. agree strongly
- b. agree
- c. neither agree nor disagree
- d. disagree
- e. disagree strongly

**B. (Item number 44 on your answer sheet)**

The instructor was an outstanding teacher!

- a. agree strongly
- b. agree
- c. neither agree nor disagree
- d. disagree
- e. disagree strongly

**C. (Item number 45 on your answer sheet)**

The subject material was extremely beneficial!

- a. agree strongly
- b. agree
- c. neither agree nor disagree
- d. disagree
- e. disagree strongly

**APPENDIX C**

**LEARNING TEST**

Appendix C is divided into several sub-sections for the purpose of clarity. Appendix C-1 lists the desired learning objectives under the appropriate lesson goal. Appendix C-2 contains the characteristics of the test instrument. It includes sections on general characteristics, reliability, validity and item analysis. Appendix C-3 is the test instrument including correct answers.

## APPENDIX C-1

### LESSON GOALS AND DESIRED LEARNING OBJECTIVES

1.0 The first goal of this lesson is that each student should demonstrate knowledge of the curve of forgetting. The desired learning objective of this goal is that each student should:

1.1 Answer correctly multiple choice questions relating the percent of forgetting after twenty minutes and one month.

2.0 The second goal of this lesson is that each student should demonstrate knowledge of distributive reinforcement. The desired learning objectives of this goal are that each student should:

2.1 Identify correctly from a multiple choice question the most appropriate schedule for reviews and the most correct amount of time to spend on each review.

2.2 Answer correctly from a multiple choice question the most correct answer identifying the advantage of distributive reinforcement from an example provided in the lesson.

3.0 The third goal of this lesson is that each student should demonstrate knowledge of the principles of learning. The desired learning objectives of this goal are that each student should:

3.1 Identify correctly from multiple choice questions the most accurate list of principles of learning.

3.2 Identify the correct principles of learning according to examples which were provided in the lesson and included in the stem of multiple choice questions.

4.0 The fourth goal of this lesson is that each student should demonstrate knowledge of the 3 - R system of learning through reading. The desired learning objectives of this goal are that each student should:

4.1 Identify correctly from a multiple choice question the most accurate list of the three steps appropriate to the 3 - R system of learning through reading.

4.2 Identify the correct statement appropriate to how a 3 - R step should be accomplished as originally provided in the lesson and paraphrased in the multiple choice question.

5.0 The fifth goal of this lesson is that each student should demonstrate knowledge of some relationships of the curve of forgetting, distributive reinforcement, principles of learning and the 3 - R system of learning through reading. The desired learning objectives of this goal are that each student should:

5.1 In an extended multiple choice question identify the appropriate items as belonging to the concept of distributive reinforcement, a set of principles of learning, or a system of application known as the 3 - R system of learning through reading.

6.0 The sixth goal of this lesson is that each student should demonstrate comprehension of some relationships of the curve of forgetting, distributive reinforcement, principles of learning and the 3 - R

system of learning through reading. The desired learning objectives of this goal are that each student should:

6.1 Identify the 3 - R steps and the most appropriate principles applicable to each step from multiple choice questions in which no examples are provided in the question.

6.2 From examples provided in the 3 - R section of the lesson and paraphrased in the stem of multiple choice questions, but without providing the 3 - R step, identify the principle of learning most appropriate to the 3 - R step.

6.3 From a list containing several pairs of terms from separate categories; i.e., distributive reinforcement, principles of learning and the 3 - R system of learning through reading; choose the terms most like each other.

7.0 The seventh goal of this lesson is that each student should demonstrate application of the concept of distributive reinforcement, the principles of learning, and the 3 - R system of learning through reading. The desired learning objectives of this goal are that each student should:

7.1 From a hypothetical example provided in the stem of a multiple choice question choose the most correct conclusion from answers that include both principles of learning and steps of the 3 - R system of learning through reading.

7.2 Choose the correct concept, principle or 3 - R step provided in the stem for several short hypothetical examples provided in the items of extended multiple choice questions.

7.3 Choose the correct concept, principle or 3 - R step for a hypothetical question supplied in the stem of that question.

## APPENDIX C-2

### CHARACTERISTICS OF TEST INSTRUMENT

#### General Characteristics of Test Instrument

The mean aggregate raw score was 22.29 for the forty-two item test. This was an arithmetic average of the total unweighted raw scores of the ninety subjects. The high, medium and low group means were similarly computed according to the three strata of thirty subjects each. The high stratum mean was 28.33. The medium stratum mean was 21.53. The low stratum mean was 11.27. These means were computed by the following mathematical notation:

$$\bar{x} = \frac{\sum_{i=1}^{i=n} x_i}{N}$$

The aggregate correct raw score range was 7 through 38. The high, medium and low strata ranges were 17 through 38, 14 through 37, and 8 through 15 respectively. The aggregate variance was 59.87. The variance was computed by the following mathematical notation:

$$s_x^2 = \frac{N}{\sum_{i=1}^N} \frac{(x_i - \bar{x})^2}{N}$$

$x_i$  = individual raw score

$\bar{x}$  = test mean

N = number of subjects

The aggregate standard deviation was 7.74. The standard deviation was computed by the following mathematical notation:

$$s = \sqrt{\frac{(x_i - \bar{x})^2}{N}}$$

The aggregate standard error of measurement was 2.908. The standard error of measurement was computed using the following mathematical notation:

$$r_{est} = s_t \sqrt{1 - r_{tt}}$$

$s_t$  = standard deviation

$r_{tt}$  = reliability of the test

The mean point-biserial correlation was .38. The mean ease index was .53. These means were computed by using appropriate transformation functions. Fisher's z was used for the correlation coefficients. The Davis item analysis chart was used for the ease index. Estimated interitem correlation was .24. This is an index of the degree which different items on the test essentially measure the same thing. It is computed by squaring the mean biserial correlation. The interitem correlation means that there was approximately a 23.5 percent overlap in the subjects interpretation of the material measured on the test.

#### Reliability

The aggregate reliability was computed from the scores of ninety subjects on the final forty-two item test. This reliability estimate was .859. The reliability estimate for the high stratum of 30 subjects

was .787. The reliability estimate for the medium stratum of 30 subjects was .739. The reliability estimate for the low stratum of 30 subjects was .778. The mathematical notation for the Kuder-Richardson formula number 20 is as follows:

$$r_{tt} = \frac{N}{N - 1} \cdot \frac{1 - \frac{\sum_{i=1}^N p_i q_i}{s_{st}^2}}{2}$$

N = the number of test items

s<sub>t</sub> = standard deviation of the test

p = percent passing a particular item

q = percent failing the same item

### Validity

Validity was not measured against an external test. Evidence that the test was valid may be assumed from four sources.

First, the script was constructed from the lesson goals. Then the test items were constructed from desired learning objectives that logically followed the lesson goals and script. This represented an attempt to incorporate content validity into the test items.

Next, the ITEMANA computer program calculated an estimate of the test validity ceiling. Statistically, the validity coefficient cannot exceed the square root of the reliability coefficient. The maximum theoretical validity coefficient for the aggregate test was .927.

Third, the individual item point biserial correlations and their corresponding t-ratios provide an indication of item validity. This

will be discussed in greater detail in the item analysis section. But Table 12 indicates that all t-ratios were significant at or above the .05 level of confidence.

Finally, statement 2 provides evidence of face validity. The statement was made by the two instructors responsible for developing and teaching the how to study course at the Air Force Academy.

#### Item Analysis

The following discussion corresponds to Table 12, Analysis by Item, columns one through eight. The table may be cross-referenced with the test instrument in Appendix C-3 and the lesson goals and desired learning objectives in Appendix C-1.

The first column merely contains a list of the appropriate test items. Columns two, three and four itemize the lesson goals, desired learning objectives and the level of achievement for each test item. Level of achievement is signified by K for knowledge, C for comprehension and A for application.

Column six lists the biserial correlation coefficient for each test item. This indicates the relationship between success on the individual item and success on the complete test. This discrimination index was calculated by the following mathematical notation:

$$r_{bis} = \frac{(X_p - \bar{X}_q)_{pq}}{S_x f(x)}$$

$X_p$  = mean score of subjects answering correctly

$\bar{X}_q$  = mean score of subjects answering incorrectly

p = item ease index

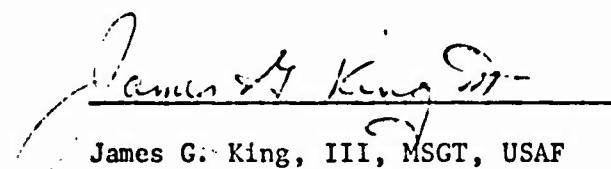
**Statement 2****Face Validity**

Date: July 30, 1970

I have reviewed the lesson goals, television programs, learning objectives and test instrument that Ronald R. Calkins created for his dissertation experiments. It is my opinion that the test is valid in that it measures what it is intended to measure.



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$f(x)$  = the y ordinate on the normal curve

$s_x$  = standard deviation of the total test

Column seven contains the point biserial correlation of each test item. The point biserial correlation is similar to the biserial correlation in that it is an indication of the relationship between success on the question and success on the complete examination. It rests on a different set of assumptions and is a more conservative estimate of the relationship than the biserial correlation. The mathematical notation for calculating the point biserial correlation is as follows:

$$r_{p \text{ bis}} = \frac{(\bar{X}_p - \bar{X}_q)}{s_x} \sqrt{pq}$$

All terms defined under biserial formula

Column eight provides an estimate of the statistical significance of the point biserial correlation. Levels of significance were annotated at the bottom of Table 12. The mathematical notation for calculating the t-ratio is as follows:

$$t = r_{p \text{ bis}} \frac{\sqrt{N-2}}{\sqrt{1 - (r_{p \text{ bis}})^2}}$$

N = size of sample (90)

Table 19  
Analysis by Item

| (1)<br>Item | (2)<br>Goal | (3)<br>Objective | (4)<br>Level | (5)<br>Base Index | (6)<br>Biserial | (7)<br>P Biserial | (8)<br>T-Ratio |
|-------------|-------------|------------------|--------------|-------------------|-----------------|-------------------|----------------|
| 1           | 1.0         | 1.1              | K            | .69               | .34             | .26               | 2.50           |
| 2           | 1.0         | 1.1              | K            | .53               | .47             | .37               | 3.76           |
| 3           | 2.0         | 2.1              | K            | .31               | .47             | .36               | 3.58           |
| 4           | 2.0         | 2.2              | K            | .59               | .55             | .43               | 4.48           |
| 5           | 3.0         | 3.1              | K            | .50               | .61             | .49               | 5.25           |
| 6           | 3.0         | 3.1              | K            | .56               | .52             | .41               | 4.21           |
| 7           | 3.0         | 3.2              | K            | .74               | .64             | .47               | 4.99           |
| 8           | 3.0         | 3.2              | K            | .38               | .55             | .43               | 4.51           |
| 9           | 3.0         | 3.2              | K            | .50               | .32             | .25               | 2.45           |
| 10          | 3.0         | 3.2              | K            | .82               | .39             | .27               | 2.58           |
| 11          | 4.0         | 4.1              | K            | .59               | .55             | .44               | 4.56           |
| 12          | 4.0         | 4.2              | K            | .57               | .42             | .33               | 3.29           |
| 13          | 4.0         | 4.2              | K            | .33               | .27             | .21               | 2.00           |
| 14          | 6.0         | 6.1              | C            | .59               | .69             | .54               | 6.05           |
| 15          | 6.0         | 6.1              | C            | .37               | .55             | .43               | 4.47           |
| 16          | 6.0         | 6.1              | C            | .44               | .62             | .50               | 5.35           |
| 17          | 6.0         | 6.2              | C            | .39               | .45             | .35               | 3.51           |
| 18          | 6.0         | 6.2              | C            | .41               | .46             | .36               | 3.62           |
| 19          | 5.0         | 5.1              | K            | .50               | .64             | .51               | 5.59           |
| 20          | 5.0         | 5.1              | K            | .44               | .41             | .33               | 3.26           |
| 21          | 5.0         | 5.1              | K            | .50               | .42             | .34               | 3.35           |
| 22          | 5.0         | 5.1              | K            | .56               | .70             | .56               | 6.33           |
| 23          | 5.0         | 5.1              | K            | .29               | .66             | .50               | 5.40           |
| 24          | 5.0         | 5.1              | K            | .77               | .33             | .24               | 2.33           |
| 25          | 5.0         | 5.1              | K            | .48               | .58             | .46               | 4.84           |
| 26          | 5.0         | 5.1              | K            | .59               | .57             | .45               | 4.75           |
| 27          | 5.0         | 5.1              | K            | .42               | .57             | .45               | 4.74           |
| 28          | 5.0         | 5.1              | K            | .52               | .47             | .38               | 3.83           |
| 29          | 7.0         | 7.1              | A            | .31               | .39             | .29               | 2.89           |
| 30          | 6.0         | 6.3              | C            | .36               | .35             | .28               | 2.69           |
| 31          | 7.0         | 7.2              | A            | .67               | .47             | .37               | 3.67           |
| 32          | 7.0         | 7.2              | A            | .79               | .34             | .24               | 2.33           |
| 33          | 7.0         | 7.2              | A            | .59               | .68             | .54               | 5.96           |
| 34          | 7.0         | 7.2              | A            | .36               | .28             | .22               | 2.13           |
| 35          | 7.0         | 7.2              | A            | .46               | .45             | .36               | 3.60           |
| 36          | 7.0         | 7.2              | A            | .72               | .51             | .38               | 3.84           |
| 37          | 7.0         | 7.2              | A            | .57               | .53             | .42               | 4.39           |
| 38          | 7.0         | 7.2              | A            | .61               | .27             | .22               | 2.07           |
| 39          | 7.0         | 7.2              | A            | .68               | .52             | .40               | 4.06           |
| 40          | 7.0         | 7.2              | A            | .62               | .59             | .46               | 4.84           |
| 41          | 7.0         | 7.2              | A            | .63               | .51             | .40               | 4.05           |
| 42          | 7.0         | 7.3              | A            | .56               | .28             | .22               | 2.13           |

Critical value of  $t_{.05} = 2.00$ ,  $t_{.01} = 2.660$ ,  $t_{.001} = 3.460$

K = Knowledge, C = Comprehension, A = Application

## APPENDIX C-3

### TEST INSTRUMENT

1. According to the curve of forgetting, how much does the average person forget after twenty minutes?
  - a. 20%
  - b. 25%
  - c. 34%
  - d. 42%
  
2. How much does the average person forget after one month?
  - a. 75%
  - b. 80%
  - c. 85%
  - d. 90%
  
3. Which is the most correct statement about distributive reinforcement?
  - a. The review periods should be regularly scheduled.
  - b. The first and last review should be the longest review periods.
  - c. The final review should occur the night before the exam.
  - d. The first review should be the longest.

4. Which is the most correct statement about the advantages of distributive reinforcement?

- a. Distributive reinforcement works because the rate of forgetting decreases after each review.
- b. Distributive reinforcement works because repetition helps the memory.
- c. Distributive reinforcement works because it produces good study habits.
- d. Distributive reinforcement works because it forces one to apply the correct principles of learning.

5. Which list includes only principles of learning?

- a. readiness, exercise, effort, recency.
- b. exercise, primacy, intensity, recency.
- c. intensity, recall, readiness, primacy.
- d. effect, review, readiness, intensity.

6. Which list includes only principles of learning?

- a. readiness - review.
- b. review - primacy.
- c. intensity - recall.
- d. none of the above.

7. What principle of learning has more to do with your attitude toward learning than any of the other principles?

- a. intensity.
- b. recall.
- c. readiness.
- d. exercise.

8. What principle of learning is mostly concerned with repetition?
  - a. recall
  - b. exercise
  - c. review
  - d. primacy
9. What principle of learning is associated with pleasant feelings or emotions?
  - a. readiness
  - b. intensity
  - c. primacy
  - d. effect
10. A willingness and desire to learn is perhaps best associated with what principle of learning?
  - a. effect
  - b. exercise
  - c. recall
  - d. readiness
11. The 3 - R system for learning through reading refers to which of the following lists of terms?
  - a. recall - reconnaissance - read
  - b. read - reconnaissance - recency
  - c. review - reconnaissance - read
  - d. readiness - read - review
12. When is the best time to apply recall?
  - a. Any time.
  - b. At the end of a chapter.
  - c. At the end of a lecture.
  - d. At the end of a paragraph.

13. According to the experiments cited in the lesson, which is the most correct statement about how much time should be spent on recall?

- a. 25%
- b. 35%
- c. 45%
- d. 55%

14. Which principles of learning are usually applied when using the first step of the 3 - R system?

- a. readiness and primacy
- b. reconnaissance and recall
- c. recency and effect
- d. recall and readiness

15. Which principle of learning is perhaps easiest to apply when using the second step of the 3 - R system?

- a. recall
- b. recency
- c. readiness
- d. reconnaissance

16. What principles of learning are probably the easiest to apply when using the third step of the 3 - R system?

- a. exercise, effect, and recall
- b. intensity, effect, and recall
- c. readiness, primacy, and intensity
- d. effect, intensity, and exercise

17. Scanning topic headings, chapter headings and summaries may result in raising some curiosity on the part of the reader. This curiosity is closely associated with which principle of learning?

- a. recency
- b. recall
- c. effect
- d. readiness

18. Humans have a tendency to remember the good experiences and forget those that were unpleasant. Thus, when a student associates a personal experience with an author's communication, it usually means that the student may be applying which principle of learning?

- a. effect
- b. recall
- c. primacy
- d. intensity

DIRECTIONS: In the televised lesson, you were provided with a concept, some principles, and a system of application to aid your study habits. In the test items number 19 through 28 below, please indicate whether the term belongs with a concept, principle, system, or none of the three.

19. reconnaissance

- a. concept
- b. principle
- c. system
- d. none of the above

20. curve of forgetting

- a. concept
- b. principle
- c. system
- d. none of the above

21. recency

- a. concept
- b. principle
- c. system
- d. none of the above

22. intensity

- a. concept
- b. principle
- c. system
- d. none of the above

23. distributive reinforcement

- a. concept
- b. principle
- c. system
- d. none of the above

24. Ebbinghouse

- a. concept
- b. principle
- c. system
- d. none of the above

25. recall

- a. concept
- b. principle
- c. system
- d. none of the above

26. effect

- a. concept
- b. principle
- c. system
- d. none of the above

27. reading

- a. concept
- b. principle
- c. system
- d. none of the above

28. exercise

- a. concept
- b. principle
- c. system
- d. none of the above

DIRECTIONS: Read the paragraph below and then choose the conclusion most appropriate to what you have learned about studying.

Bill would never study until the night before an exam. Then he would cram. He seemed to get away with it.

29. Which conclusion is most appropriate to what you have learned about studying?

- a. More than any thing else, Bill was probably applying recall in his study habits.
- b. More than any thing else, Bill was probably using reconnaissance as an aid to his study habits.
- c. More than any thing else, Bill was probably applying recency as an aid to his study habits.
- d. More than any thing else, Bill was probably using primacy as an aid to his study habits.

30. Which pair of items is most like each other?

- a. reconnaissance - primacy
- b. recall - exercise
- c. curve of retention - recency
- d. readiness - effect

DIRECTIONS: In the following items, question number 31 through number 37, you are to judge what is most appropriate to correct the situation from the list of terms below. Each term may be used once, more than once, or not at all.

- a. distributive reinforcement
- b. reconnaissance
- c. effect
- d. recency

a 31. Jerry has a hard time remembering.

c 32. Bob cannot stand the hot, drab, and dirty classroom.

b 33. Jose always gets too involved in details.

d 34. Hank has a test tomorrow

d 35. The instructor always gives a pop quiz over the previous day's notes.

a 36. Bob is smart, but he just cannot seem to get organized.

a 37. Jerry always makes average grades by cramming right up to exam time.

DIRECTIONS: In the following items, questions number 38 through number 41, you are to judge what conclusion is most appropriate to the situation. Each conclusion may be used once, more than once, or not at all.

Conclusions

- a. The situation would probably be true if distributive reinforcement had been used.
- b. The situation would probably be true if readiness had been applied.
- c. The situation would probably be true if effect had been applied.
- d. The situation would probably be true if intensity had been applied.

a 38. This student made excellent grades without seeming to put any more time at studying than the average person.

b 39. This student always seemed eager to learn about new things.

c 40. This class liked the instructor.

a 41. This student did well although the one final exam counted for the entire course grade.

42. Why should the Air Force prefer to train only volunteers for jobs such as para-medics and pilots?

- a. primacy
- b. distributive reinforcement
- c. effect
- d. readiness

END